COMMERCIAL FISHERIES Review

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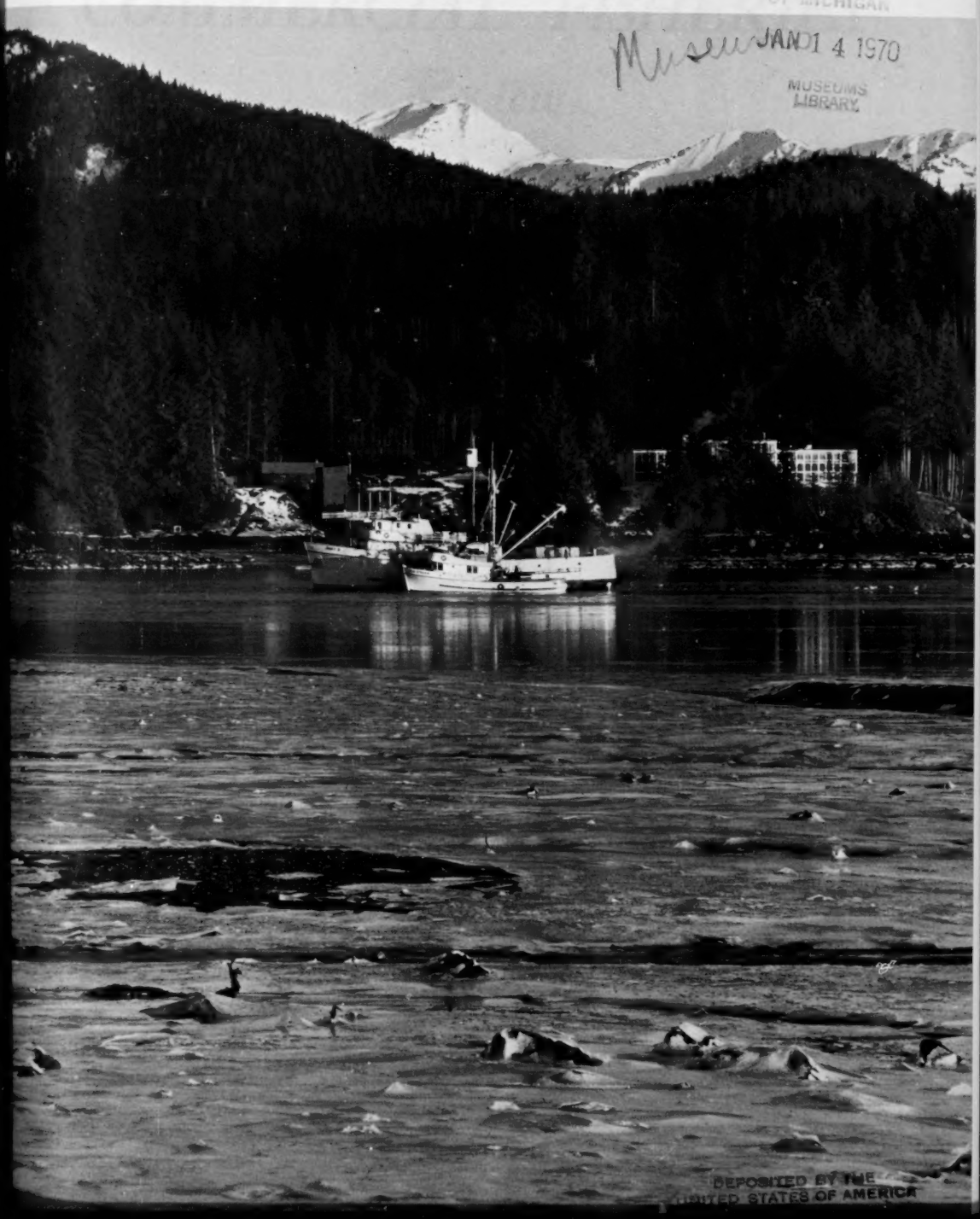

COVER: A crab processor and catcher boat anchored off BCF Biological Laboratory, Auke Bay, Alaska. (Photo: J. M. Olson)

COMMERCIAL FISHERIES

Review

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.

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Throughout this book, the initials BCF stand for the Bureau of Commercial Fisheries.

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CONTENTS

Horn Island, part of Gulf Islands in Gulf of Mexico off Texas. (National Park Service, M. W. Williams)

INTERIOR SEEKS COASTAL-ZONE LEGISLATION

The Department of the Interior has asked Congress to establish a new national program to encourage and help coastal and Great Lakes states to protect and develop their estuarine and other coastal lands and waters. The proposed legislation is based on a 3-year Estuarine Pollution study recently completed by Interior's Federal Water Pollution Control Administration.

The legislation would authorize matching Federal grants to coastal and Great Lakes states to develop comprehensive management programs for their coastal zones. These programs would follow guidelines that are established to promote the national interest. Follow-up matching Federal grants would be provided the states to carry out the plans.

The Estuarine Study reveals that long-range land and water management is mandatory to balance increasing demands on the vulnerable estuarine waters and wetlands.

Irreplaceable Areas

Secretary of the Interior Walter J. Hickel said: "Our coastal and estuarine areas contain irreplaceable habitat for most of our sport and commercial fisheries, as well as waterfowl and other wildlife. These areas are used for recreation and enjoyment by millions of people, and the demand is rapidly increasing.

"But it is here where our population and technological pressure are the greatest. Consequently, these resources are susceptible to man's alterations, such as pollution, housing and industrial development, which continue without a comprehensive plan on a piecemeal basis.

"The legislation would assist and strengthen the role of the coastal states in the orderly planning of their land and water resources of the coastal zone."

$2 Million U.S. Grant

Under the legislation proposed by Interior, the Federal Government would be authorized to grant, on a matching basis, $2 million for fiscal year 1971. The U.S. also would make available "such sums as may be necessary for the fiscal years thereafter prior to June 30, 1975" to assist states in developing comprehensive coastal zone management programs. (See Gulf Coast, pages 11-15.)

UNITED STATES

TEKTITE II IS SCHEDULED FOR SPRING 1970

The most ambitious underwater exploration program ever attempted--Tektite II--was announced on Oct. 31, 1969, by Secretary of the Interior Walter J. Hickel. More than 50 scientists and engineers, including some from abroad, will spend varying periods in the ocean over a 7-month span.

The operation will begin spring 1970 off St. John, U.S. Virgin Islands. This was the site of Tektite I, Feb. 15-Apr. 15, 1969, in which four Interior Department scientists spent a record-breaking 60 days living on the ocean floor.

Cooperative Effort

Tektite II will be a cooperative effort of government and private organizations. The lead agency will be Interior. Others include: the National Aeronautics and Space Administration, the National Science Foundation, the Department of the Navy, the Government of the Virgin Islands, the Smithsonian Institution, Public Health Service, the U.S. Coast Guard, and the Environmental Science Services Administration. Universities will participate: New Hampshire, Texas, Rhode Island, and the College of the Virgin Islands.

The General Electric Company, which designed and built the Tektite habitat, is providing it again. GE will furnish engineering support.

Vital to U.S.

Secretary Hickel said: "The Department of the Interior intends to play a major and active role in exploring and developing our Nation's marine resources. It is vital to the United States' continued growth and development that the secrets locked in this last frontier of our planet be uncovered and fully developed and utilized to meet many of the pressing demands of the future."

Study Ocean & Man

The Tektite II program will include a major marine scientific mission and extensive human behavioral studies. As in Tektite I, special emphasis will be placed on the behavioral and biomedical problems of small crews living in isolation for long periods under stress. These are the conditions that may be encountered in space and undersea exploration.

New equipment and techniques will be developed and evaluated for increasing man's undersea performance: oceanographic instrumentation, underwater communications and navigation equipment, swimmer propulsion systems, and long-duration, closed-cycle SCUBA devices.

The Habitat

The main 2-story undersea laboratory-dwelling will be 50 feet down. A smaller 2-man habitat at 100 feet will determine whether nitrogen/oxygen breathing mixtures can be used safely there.

U.S. FISHERY PRODUCT CONSUMPTION IS STABLE

At the end of September 1969, U.S. supplies of edible fishery products were about the same as a year earlier. Larger frozen stocks at the start of 1969 and heavier imports are offsetting a probable decline in domestic landings of edible fish. Per-capita consumption in 1969 likely will equal 1968's 11 pounds. Of this figure, about 6 pounds will be fresh and frozen, 4½ pounds canned, and ½ pound cured products.

Inventories Slightly Lower

November 1969 inventories of all frozen fish and shellfish combined were 4% below last year. They dipped below year-ago levels for the first time this year in September. Holdings of fish are down 10%, but shellfish are 13% above 1968. November 1969 inventories of fish sticks and portions were down 17%, mainly because sales in first-half 1969 were 28% greater than 1968.

More Shellfish Stocks

Larger stocks of shellfish resulted from sluggish sales reflecting consumer resistance to higher prices in 1969. Retail prices for all fishery products have been running 4 to 5% above a year earlier. The increase is less than that of meat and eggs--but larger than for most other foods.

Wholesale Price Higher

Wholesale fish prices have been running 10% higher than a year ago. Wholesale prices for fresh and frozen fish and shellfish are averaging 15% higher; prices for some canned products are averaging a fraction below last year. Fish sticks and portions--and cod and ocean-perch fillets--are among the few fresh and frozen items whose prices have not advanced much.

Imports Higher

Imports of edible fishery products through August 1969 were 4% above a year earlier. Imports of fish fillets rose 16%. Imports of frozen tuna were about the same as 1968; imports of canned tuna increased nearly a fourth. Imports of shellfish also were higher, sparked by an 8% increase in shrimp.

New England Landings Drop

Landings of edible fish in New England through September 1969 were 15% less than in 1968. Among the popular varieties, flounder landings were up slightly. Cod increased 17%. More than offsetting these increases were declines of 37% for haddock, 8% for ocean perch, and a more than 50% drop in whiting catch.

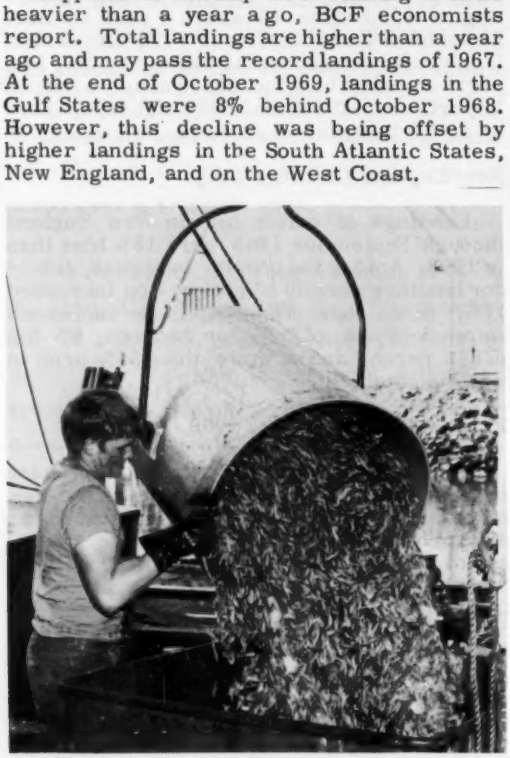
Forecast Through Dec. 1969

BCF economists provide this forecast for major fishery products for the remainder of 1969: Supplies of most fishery products are expected to be ample, although price levels, in general, will be higher than last year. Supplies of fresh and frozen salmon and Pacific halibut will be heavier than in 1968. Domestic production of canned tuna may be off a little. Inventories of frozen crabs are considerably above a year ago. These resulted in some price weakness recently for all varieties of West Coast crabs. Prices for live lobsters likely will average higher than a year ago; supplies will be about the same. Supplies of haddock will remain relatively short and prices higher than a year earlier. Supplies of cod fillets will be heavier than a year ago and prices about the same as in late 1968. Supplies of flounder and ocean perch fillets likely will be a little larger and prices higher.

SITUATION & OUTLOOK: SHRIMP, SEA SCALLOPS, NORTHERN LOBSTERS, SPINY LOBSTER TAILS

SHRIMP

Supplies of shrimp are running a little heavier than a year ago, BCF economists report. Total landings are higher than a year ago and may pass the record landings of 1967. At the end of October 1969, landings in the Gulf States were 8% behind October 1968. However, this decline was being offset by higher landings in the South Atlantic States, New England, and on the West Coast.



A bucket-load of Kodiak-caught shrimp is dumped in a processing plant container. (BCF-Alaska photo: J.M. Olson)

Imports

In the first 10 months, imports were about 5% above a year earlier. Imports for 1969 probably will set a new record at close to 220 million pounds, heads-off weight.

Fresh & Frozen Shrimp

Sales of fresh and frozen shrimp dropped sharply--about 7%--during the first 10 months of 1969. Total sales of fresh and frozen shrimp likely will be 15 to 20 million pounds, heads-off weight, lower than last year. The sales decline probably is the result of these factors: (1) record high prices, (2) no gain in "real" disposable personal income in 1969 after allowances are made for inflation, and (3) little growth in restaurant sales.

Inventories Rise

Inventories are considerably above a year ago because sales dropped while supplies increased slightly. Cold storage holdings on January 1, 1970, probably will be higher than this year's carryover and may be slightly higher than the record inventory at the start of 1968.

With record prices at all levels, no gain over a year earlier was expected in sales of fresh and frozen shrimp during November-December 1969 if prices remained at mid-November levels. A slight drop in sales from last year may be in prospect.

In light of the current inventory and sales situation, price strength does not appear likely except, possibly, for larger-sized shrimp. Even if prices hold steady at current levels, they still will average considerably higher than in November-December 1968.

SEA SCALLOPS

Total supplies are down 15% from a year ago. The general decline in abundance of northwest Atlantic sea scallops continued in 1969. Landings in New England are the lowest since 1945. Landings in Middle Atlantic and Chesapeake Bay States are much below a year ago. Scallop landings in Alaska have not been large enough to offset the East Coast deficit. Scallop landings in Canada and, consequently, scallop imports are down about 10% from January-October 1968.

Consumption of sea scallops also is down about 15%. Demand for sea scallops has not declined in 1969 even though consumption fell considerably. Lower supplies and higher prices caused the drop in sales. Because of this drop, prices for sea scallops at all levels have risen sharply since midyear 1969; currently, these average considerably higher than a year ago.

Though a drop in sales was expected during November-December 1969, compared with a year ago, inventories on January 1, 1970, probably will be lower than at the start of 1969.

Prices for the rest of 1969 will average much above a year ago and will continue high in the early months of 1970. Scientists expect abundance to continue low--so the prospect for increased domestic landings of sea scallops in 1970 is not bright.

NORTHERN LOBSTERS

Landings in Maine are down a little this year, but the decline probably is being offset by increased landings from offshore areas where lobster pots are being fished. Total landings for 1969 likely will be about the same as 1968. Imports from Canada also are about the same as a year ago.

During January-September 1969, prices paid to fishermen and at wholesale averaged nearly the same as in 1968. Prices are higher now and are expected to remain above year-ago levels for the rest of 1969. Prices for 1969 will average higher than a year ago--the effect of strong demand on a relatively fixed supply.

SPINY LOBSTER TAILS

Supplies of imported spiny lobster tails are slightly heavier in 1969 than in 1968. Imports were down a little for the first 10 months, but higher inventories account for the larger supplies.

Imports of cold-water tails are down considerably this year. As a result, warm-water tails have a much larger share of the market than in previous years.

The almost constant increase in lobster tail prices since mid-1967 halted in summer 1969. In first-half 1969, prices for cold-water tails were 90 cents to $1 higher than a year ago. Resistance to the price climb has been evident all year: sales have lagged 8 to 10% and inventories have mounted. Prices have dropped sharply since midyear--as much as a dollar per pound for cold-water tails--as efforts are being made to increase sales and decrease inventories before the seasonal upswing in imports at the beginning of 1970.

Supplies of lobster tails will be plentiful for the rest of 1969. Lower prices likely will increase the sales over November-December 1968. However, the January 1, 1970, carryover in cold storage will be considerably above that at the start of 1969 and likely will be a record. With high inventories at the start of 1970, and seasonally heavy imports, relatively stable prices are in prospect for the early months of 1970.

FIRST TAGGED ATLANTIC SWORDFISH RECOVERED

The first swordfish ever to be tagged and recaptured in U.S. Atlantic waters was taken off Martha's Vineyard, Mass., reports the Sandy Hook Marine Laboratory (Highlands, N. J.) of Interior Department's Bureau of Sport Fisheries and Wildlife. When recaptured, about 48 miles east-southeast of tagging site, it had been at liberty almost 4 years--1,408 days. It weighed 356 pounds dressed; its total weight was about 535 pounds.

Montauk & Martha's Vineyard Sites

The swordfish was first caught and tagged on Aug. 25, 1965, 20 miles south of Montauk, N. Y. The tag was an M-type dart tag, a tiny stainless steel harpoon with a plastic message capsule attached. The fish was harpooned and recovered on July 4, 1969, about 40 miles south of Martha's Vineyard.

Swordfish Distribution

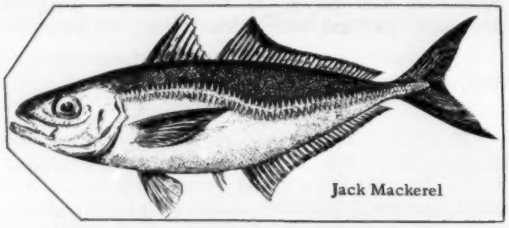
Swordfish are found throughout the world in tropical and temperate areas. They are recorded from Newfoundland to Cuba in the western north Atlantic. Present off the north Atlantic coast from late June or early July, they remain throughout the summer. Then they move south and offshore into deeper water along the edge of the continental shelf. Swordfish are sought by anglers and commercial fishermen using hook and line, harpoons, and longline gear.

World Record

The world's record hook-and-line swordfish was taken off Chile. It weighed 1,182 pounds. The largest taken in the western north Atlantic was 602 pounds. Swordfish taken along the Atlantic coast in recent years averaged 200 to 300 pounds, although several fish over 300 pounds were reported in 1969.

JACK MACKEREL'S SWIMMING SPEED IS DETERMINED

Dr. John Hunter of BCF's laboratory in La Jolla, California, has completed a study of the swimming ability of the jack mackerel. This medium-sized predator ranges over a million-square-mile oceanic region off the west coast of North America from Mexico to Alaska. It is an area as big as Alaska, Texas, and California combined.



Jack Mackerel

Dr. Hunter and his assistants worked with a flow channel he designed. This flow channel is the "wet" equivalent of a wind tunnel or treadmill. The major features of swimming behavior he studied were the frequency of the tail beat, the amplitude of the tail beat, and the relationship of these two factors to swimming speed and body length. He found a simple mathematical relationship among these factors that could be applied as well to many other kinds of fish.

Determining Its Speed

When swimming at a constant speed, the amplitude of the tail beat was a constant $\frac{1}{5}$ of the fish's body length. The tail of a ten-inch jack mackerel moves back and forth 2 inches. The swimming speed itself is a simple function of tail-beat frequency. When the tail beats 9 times per second, the 10-inch fish is propelled at 4 miles per hour (3.5 knots); when the tail beats 4 times per second, the fish moves 1.4 miles per hour (1.25 knots).

When changing speeds, the amplitude of the tail beat increases momentarily until the new constant speed is attained when the amplitude drops back to the constant $\frac{1}{5}$ body length and the tail-beat frequency characteristic of the new speed is retained. Tail-beat frequencies up to 25 per second were recorded, but no fish was able to keep a "pace" greater than 10 beats per second. At 8 beats per second, the fish could swim almost indefinitely.

Can Swim Far

It is now possible to illustrate how the jack mackerel may range over the 2000 x 500 mile area of the northeast Pacific. At the high cruising speed (4 mph), the jack mackerel could swim 1000 miles in about 11 days; at the lower cruising speed, the same fish would cover this distance in a month. Adult jack mackerel are about 20 inches long. They could easily range 1000-1500 miles between the breeding grounds off Mexico and the feeding grounds off Washington, British Columbia, and Alaska. If the jack mackerel had a good sense of direction, the entire 3000-mile round trip could be accomplished in about 45 days.

Speed Probably Geared to Food

An older generalization pertaining to all travel in air and water is that it takes about 4 times as much energy to travel at twice the speed. The swimming speed the jack mackerel uses when searching for food is probably geared to the amount of food the fish is likely to find. Schooling habits of the jack mackerel and their food will have to be studied to unravel this.

These basic swimming facts were applied to fish as widely different as a goldfish and shark. It appears that the simple mathematical relations developed from the jack mackerel study may bear on much wider swimming-speed problems. This generality may be sufficient for many questions about swimming speed. The estimates from such a generality will provide the starting point for more precise work on other species. Dr. Hunter's study will save much time, effort, and money in new research programs seeking to estimate and define swimming speeds.

BCF DISTRIBUTES ALASKAN FISHING LOG OF SCALLOP EXPLORATIONS

BCF's Exploratory Fishing and Gear Research Base in Juneau, Alaska, has made available to fishermen and other interested persons a fishing log of Alaska scallop explorations conducted in summer 1969. The explorations started west of Kodiak Island and extended westward along the southern coast of the Alaska Peninsula.

90-Day Scallop Explorations

On Aug. 19, 1969, the charter vessel 'North Pacific' completed 90-day scallop explorations to locate beds of commercial importance in this area. The cruise involved a search pattern of 646 stations at 5-mile intervals within the 25-60-fathom depth zone. Thirty-minute dredge hauls were made at each station using a standard commercial 13-foot, New Bedford-type, scallop dredge with 4-inch rings and using 1-inch cable.

Fig. 1 - Bags of iced scallops wait to be processed in this Seward, Alaska, processing plant.

Fig. 2 - Scallops are packed in 5-pound boxes at Alaskan Scallop Fleet plant in Seward.

Fig. 3 - Scallops are placed in refrigerated vans for shipment to 'south 48' (U.S.) via van ships.

(All BCF-Alaska photos: J. M. Olson)

NORWEGIAN HOLDING NET TESTED IN MAINE SARDINE FISHERY

Kenneth Sherman

Sardines (juvenile Atlantic herring, Clupea harengus harengus) with excessive amounts of food in their stomachs are not suitable for canning. In Maine, fishermen have traditionally used weirs and stop seines for catching sardines nearshore, and have had little difficulty in holding fish until they were sufficiently clear of food for canning. Since 1962, however, a purse seine fishery for sardines has grown rapidly. Purse seine fishermen, lacking the protection found in inshore waters, have been obliged to send their catches immediately to a cannery for processing. The incidence of fish that are unacceptable for canning because of a "feedy" fish condition is thereby increased; these fish are diverted for use as fish meal. Norwegian fishermen have solved a similar problem by designing a holding net for use in the open sea.

Norwegian Holding Net

The Maine Sardine Council invited Captain Arne Gronningsaeter of Landfast, Norway, to demonstrate the use of the Norwegian holding net to the Maine sardine industry. A sea trial of the net was made in September 1969 with a commercial purse seiner. The Bureau of Commercial Fisheries Biological Laboratory, Boothbay Harbor, Maine, cooperated in the trial by examining the changes of food content in the sardines during the holding period.

Captain Gronningsaeter instructed the captains and crews of Maine purse seiners in the handling of the holding net, which is available in a variety of sizes. The model used in the sea trial was 35 meters (115 ft.) long, 9 meters (30 ft.) wide, and 8 meters (26 ft.) deep. The netting on the sides and bottom is knotless nylon with stretched mesh of $1\frac{1}{8}$ inches. It is designed to hold up to 100,000 pounds of live sardines. In practice, the fish are transferred to the holding net immediately after they are purse seined and towed at 1 to $1\frac{1}{2}$ knots to a protected area. There, the net is anchored and the fish are left until cleared of food. The holding net in the anchored position is shown in figure 1.

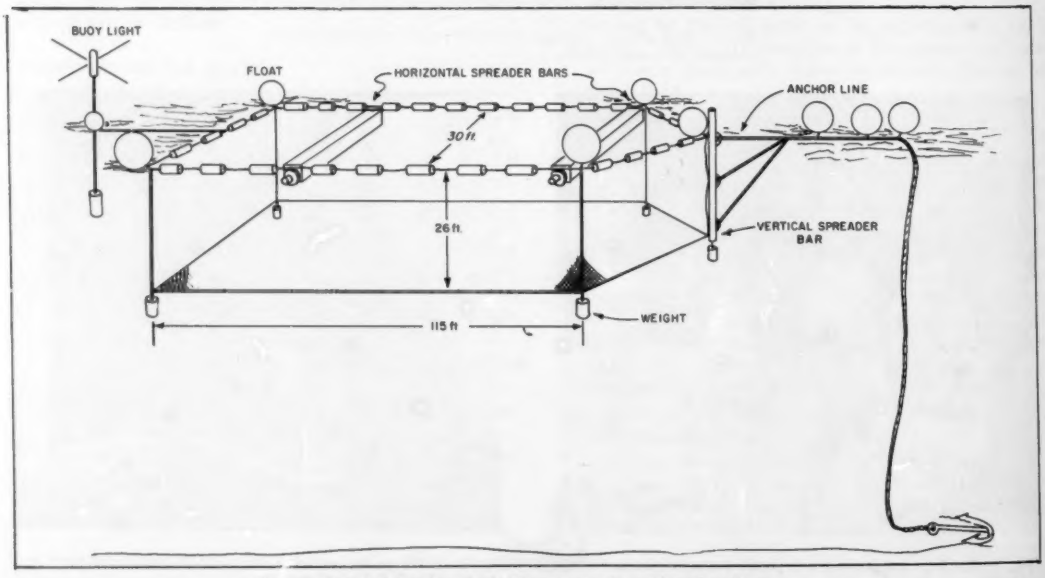


Fig. 1 - Drawing showing the holding net in the anchored position.

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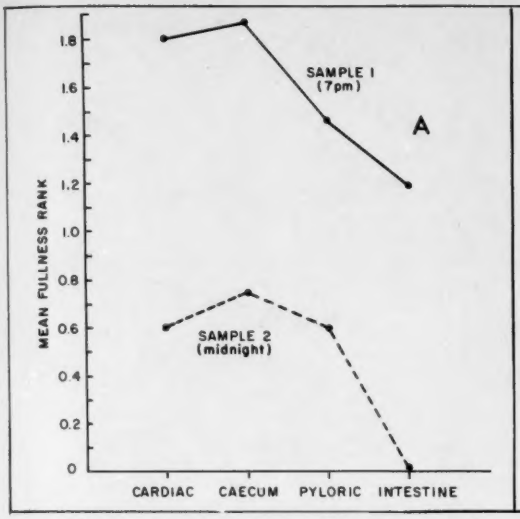


Fig. 2(A) - Comparison of the fullness rankings of the juvenile herring at the beginning of the holding experiment (sample 1 taken at 7 PM) and at the termination (sample 2, midnight). The values represent the mean rank of 10 fish selected from each sample. Rankings were made for major divisions of the digestive tract--the cardiac, pyioric, and caecal sections of the stomach and the intestine (0, devoid of recognizable food; 1, trace of food; 2, moderately full; and 3, moderately to completely full).

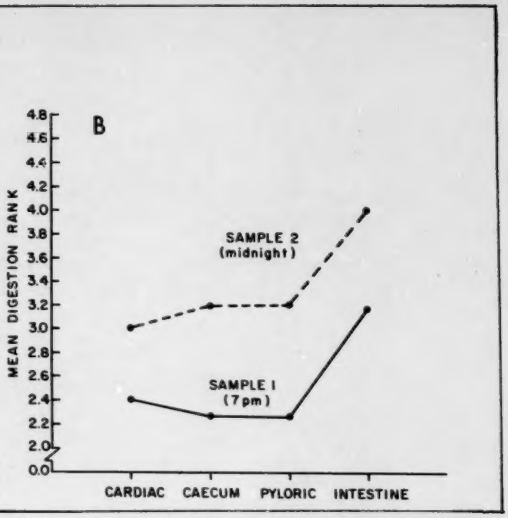


Fig. 2(B) - Comparison of the rankings of digestive stages of food in juvenile herring at the beginning of the holding experiment (sample 1) and at the termination (sample 2). The values represent the mean rank of 10 fish selected from each sample (1, slight digestion; 2, moderate digestion; 3, moderate to complete digestion; and 4, food liquified, with oil globules present).

Net's Effectiveness Tested

The effectiveness of the holding net for clearing "feedy" sardines was tested during a special cruise of the BCF research vessel 'Rorqual' on September 14 and 15, 1969. Determinations of the feeding activity of sardines in the net were made in cooperation with the purse seiner 'Eva Grace.' A set of about 37,000 pounds of herring was made by the seiner at 7 pm a quarter-mile east of Ragged Island, Maine (latitude 43°49.5' N., longitude 68°52' W.). The sea was calm and the quarter moon obscured by cloud cover. The fish (ranging in length from 213 mm to 247 mm) were sampled immediately after transfer to the holding net, and again at midnight just before they were pumped into the carrier.

Digestive Tracts Examined

The digestive tracts were examined in the laboratory. Contents of the stomach--including the pyloric, cardiac, and caecal sections--and intestine were examined under 25X to 600X magnification. Rankings were made of the degree of fullness and stage of digestion (Figs. 2A and B). The amount of food in the herring after they were held for 5 hours was considerably less than when they were seined (66% less in the cardiac stomach and no food in the intestine); food in the digestive tracts was also in the late stages of digestion when the experiment ended.

The alimentary tracts cleared significantly in the holding net. When seined, the fish contained remains that were predominantly copepods, the zooplankters that were also the most

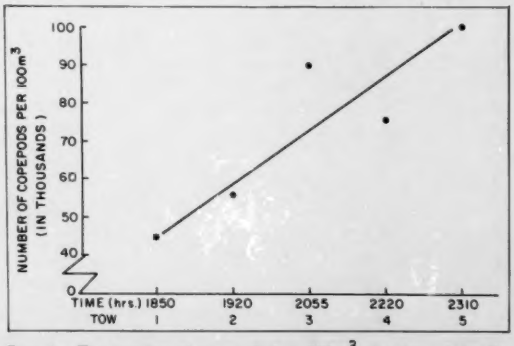


Fig. 3 - The number of copepods (per $100m^3$ of water strained) in the test area during the holding experiment.

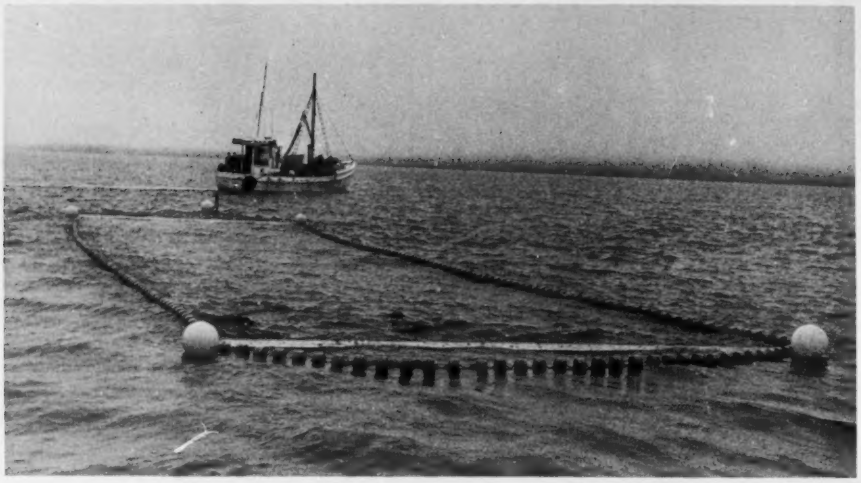


Fig. 4 - The holding net under tow. (Photo: Gareth W. Coffin)

numerous in the test area. The numbers of copepods in the area increased from 7 pm to midnight (fig. 3), while the amount of food in the restrained fish was decreasing. The increase in abundance of zooplankton reflects the vertical movement of plankters to the surface waters in the evening, and to the lower depths in daylight.

The water mass did not change significantly during the experiment. Temperatures were between 12.8° C (55° F) and 13.0° C (55.4° F) at the surface and between 10.8° C (51.4° F) and 11.7° C (53° F) at the bottom. The bathythermograph traces showed no evidence of a thermocline. Salinity was 31.9 ‰ at the surface and 32.4 ‰ on the bottom.

Sardines in Good Condition

The sardines were in good condition at the conclusion of the experiment. No dead fish were observed in the holding net. By transferring the fish, the seiner was free to make an additional set, while enhancing the quality of the confined fish. The holding net under tow is shown in figure 4. Several sardine-plant owners have indicated that they will purchase holding nets for their purse seiners.

Whether the decrease in the feeding of sardines can be attributed to a stress condition imposed on the fish by the artificial confinement--or to the general decrease in feeding known to occur among herring during nights with weak moonlight--remains an open question requiring further study. The level of stress experienced by fish in a holding net is probably related to crowding, which will also result in a decrease in the availability of food to each fish. In addition, digestion is a function of temperature and the kind of food eaten. Clearing time during the colder months will be longer than at the higher temperatures in spring and summer regardless of stress. Within the framework of a controlled experiment, it should be possible to test effects of change in crowding, temperature, and food quality on clearing time.

THE GULF COAST: 1. DANGER IN THE ESTUARIES

NEW U.S. policy aims to promote development of coastal areas and the Great Lakes. The Coastal Zone of the Gulf of Mexico is an important part of this national goal. The October 1969 issue of 'Gulf Review,' published by the 18 Southern institutions of higher learning in the Gulf Universities Research Corporation, focuses on the Gulf.

"Estuaries and pollution have become inseparable in America's affluent society," the newsletter states. Each year in the U. S., public health officials condemn more shellfish water because of pollution than they reopen. Estuarine pollution is a very important matter in the Gulf Coast area, which produced more than 275 million pounds of shellfish in 1967.

Gulf's Shoreline 88% Estuarine

'Gulf Review' states: "The Gulf's 17,141 miles of tidal shoreline are 88 percent estuarine in character. Thirty-nine primary estuarine systems and 175 secondary-tertiary systems account for approximately 60,000 square miles along the Gulf. And these systems serve as receptacles for run-off from all or part of thirty-one states. Twenty-four U.S. trunk rivers, draining more than 1.5 million square miles of land, dump approximately 700 million tons of sediment into the Gulf estuarine environment. These rivers have an average total discharge amounting to 205.5 cubic miles of water which pass through the estuarine environment each year. The sediment and waters which eventually find their way to the Gulf carry with them chemical wastes, industrial pollutants, insecticide and pesticide residue, and myriad other man-produced toxins which threaten the life of the Gulf's estuaries.

"The effects of man have already begun to show up. The U.S. commercial catch of eight species of estuarine dependent fish in the Gulf and Atlantic coasts fell from 393 million pounds in 1955 to 291 million pounds in 1965."

Texas Pesticide Study

The Texas Parks and Wildlife Department has been studying pesticides, primarily DDT, since 1965. It has monitored most of the State's coastal bay system and taken random samples from the Gulf. Oysters, forage fish, game or predator fish, and shore birds have been included.

The highest residues have been found consistently in the Lower Laguna Madre. In forage fish samples, average DDT residues ranged from 0.173 part per million (ppm) to 3.275 ppm.

All oyster tissue samples averaged much less than 1 ppm DDT or other pesticides.

'Gulf Review' states: "Evaluation of the data taken during the study indicates that the impairment of reproductive ability and decrease in the survival of young are the greatest dangers to a species at the present time." DDT residues in the Texas study were "still much below the danger level." The newsletter notes that DDT has been banned in some parts of the U.S. because of its effects on the marine environment.

2. MARSHES & MARICULTURE

"Much of the coastal zone of the Gulf of Mexico is marshland. The Gulf's lowlands and deltas, fed by the discharge of 24 U. S. rivers, account for hundreds of thousands of square miles of the coastal zone. In this soft, wet, and often inundated land, tidal pools provide a breeding ground for marine life and establish a refuge for sea birds and other wildlife.

"Conservationists have long appreciated the vast desolation of the salt marshes but the interests of industry, agriculture, and other user groups have recently turned to this resource."

Pompano Research in Louisiana

Louisiana State University (LSU) and Texas A&M University (TAMU) are conducting Sea Grant-sponsored fishery studies in Gulf marshlands.

The LSU work has shown that pompano can live in water that does not have the high salinity content of their native ocean habitat. Pompano are growing in tanks with water of

salinity comparable to the brackish water of the Louisiana marshes.

LSU scientists believe the fish can be raised in brackish water ponds in the widespread Louisiana marsh. Pompano fish farms would develop--as with catfish. If the research shows pompano can be farmed successfully, "pompano crops may become an important new industry for the marsh country."

In the first experiments, pompano fingerlings placed in ponds did not grow to market size in a year. But the researchers are optimistic.

Texas Research on Shrimp Farming

Near Angleton, Texas, TAMU is experimenting with marsh use for shrimp farming. Researchers are developing manmade ponds in the boggy marsh.

Three natural marsh ponds were leveed and ten half-acre reservoir type ponds were built. In April 1969, 17,000 post-larvae brown shrimp averaging 8 mm were put in a $1\frac{1}{2}$-acre natural pond. Ninety days later, the shrimp had reached mean length of 147 mm; market value was 856 per pound.

In July, a harvest flume designed by the researchers collected the shrimp. The flume is a floodgate through which water is drained from pond. Shrimp are trapped in a net stretched across the flume. The brown shrimp were susceptible to the flume. They reacted as though they were returning to the Gulf on an outgoing tide.

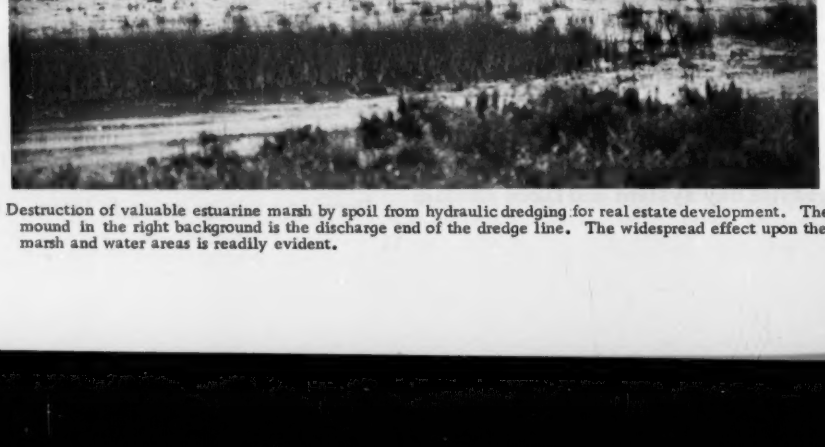
Fish Predation A Problem

In the first experiment, the chief problem was that fish ate many shrimp. To evaluate effect of the fish predation, the natural ponds were stocked in August with juvenile white shrimp. A fish toxicant, rotenone, was applied to one pond. Diuron was used to control all aquatic vegetation. A commercial catfish food supplemented natural foods.

Early sampling showed survival in all ponds greater than in the earlier experiment. Where predators were eliminated, growth rate was highest. The researchers advise that an accurate measure of survival will have to wait the shrimp harvest.

BEFORE

AFTER



Destruction of valuable estuarine marsh by spoil from hydraulic dredging for real estate development. The mound in the right background is the discharge end of the dredge line. The widespread effect upon the marsh and water areas is readily evident.

3. CAMILLE: DEVASTATES GULF COAST

In early morning, Monday, Aug. 18, 1969, as Hurricane Camille's 200-mile-an-hour winds lessened, the U.S. Food and Drug Administration's New Orleans District put into operation its prepared plan to meet a natural disaster. All inspectors, chemists, sanitation engineers, and microbiologists were alerted for service. Other FDA districts sent specialists.

Using whatever means of communication were still working, FDA contacted State and local health and civil defense officials in Mississippi, Louisiana, and Alabama to determine the hardest-hit areas and the ways FDA could help.

The following are excerpts and photos from 'FDA Papers', October 1969, which tell part of the FDA operation following Hurricane Camille.

"After building steadily to full intensity for several hours, Hurricane Camille's Sunday punch came at 10 p.m. August 17, striking the Gulf Coast with unprecedented 200-miles-an-hour winds that continued unabating until 2 a.m. Monday. Although the entire coastal area felt some of the hurricane's impact, its biggest was against the coasts of Mississippi, southeast Louisiana, and Alabama, destruction by winds ranging in some places up to 200 miles inland. Along the Mississippi and Louisiana coasts tidal waves up to 20 feet high slammed impartially into the works of man and nature alike, destroying, flooding, and killing.

"Within 48 hours the same hurricane was to carry torrential rains as far as central Virginia, precipitating flash floods there that brought further death and destruction, before heading out to sea to die in the Atlantic.

"On the Gulf Coast the hurricane, its potential death toll kept down only by hurried, partial evacuation of the most dangerous areas, had left thousands homeless and jobless, had wiped out almost the entire economies of some cities that were built largely on seafood processing and the tourist trade, and had so flattened the mostly residential Mississippi city of Pass Christian that it was later almost entirely reevacuated of returning inhabitants. It had left almost all the immediate coastal areas without electric power,

Fig. 2 - A field of cans: seafood and fruit drinks.

telephones, gas, passable roads and bridges, potable water supplies, workable sewerage, safe food, and adequate medical facilities and supplies.

"The winds and tidal waves had downed or defoliated trees small and large, had twisted steel and concrete structures and undermined pavements and seawall, and had even beached three oceangoing freighters docked and lashed together at Gulfport, Mississippi, along with many smaller vessels. In most areas waterfront structures were flattened or in ruins, including those of the extensive seafood packing industry along the coastline, where these products in cans were scattered and exposed to the elements and to hungry human scavengers.

"Flooded, mosquito-breeding areas, dispossessed rats, snakes, and other vermin,

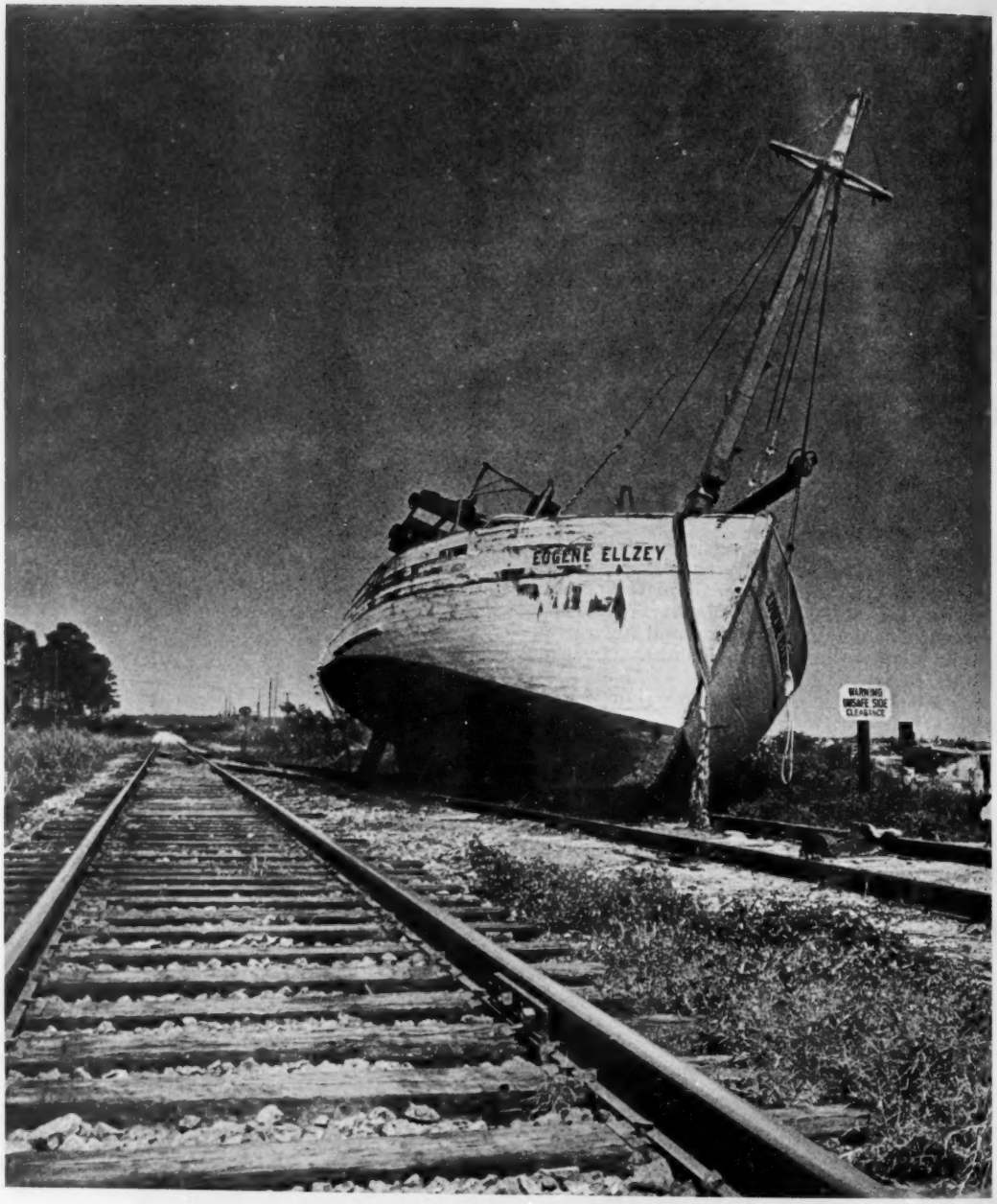


Fig. 1 - One of shrimp trawlers beached by Camille.

Fig. 3 - Employes of seafood packing plants wash and sanitize cans in vast salvage operation. (All photos FDA)

and the unburied bodies of animals and humans, unfit drinking water, unrefrigerated perishable foods, the lack of public eating and sleeping accommodations, together with intermittent spells of rain and hot sun, posed the threat of famine and disease. Clearly, the hurricane had left in its wake a public health problem of the worst order, one that called for the utmost and combined efforts of State, local, and Federal health, law enforcement, and civil defense officials, the military, and the citizenry."

Seafood Inspection

FDA inspectors began the enormous job of checking, "street-by-street, door-to-door," seafood-processing and other food firms to see what foods could be saved and what had to be thrown away.

An FDA "reconditioning" team "kept watch over the operations of firms seeking to recondition products potentially fit for distribution into commerce. For canned seafood and other canned products, reconditioning consisted of sorting unlabeled cans by code numbers stamped on the can to identify the product, washing the can in detergent, and dipping it in a sanitizing bath. Cans beginning to rust were examined for pinholes and were required to be buffed to remove traces of rust. The reconditioning was a special problem because of the unavoidable exposure of the cans to the weather and the difficulty the firms encountered in finding qualified people to do the salvaging work. . .

"At the Port of Gulfport (Miss.) some 800 tons of fishmeal and a million one-pound cans of cat food were flooded, and FDA Inspectors maintained surveillance over destruction by burial of all but 100 tons of the fishmeal that was removed to Louisiana for reconditioning under an agreement reached between Mississippi and Louisiana State authorities."

1968 GREAT LAKES COMMERCIAL FISHERY PRODUCTION DECLINED

The 1968 catch by U.S. and Canadian Great Lakes commercial fishermen was 115.7 million pounds, about 12 million below 1967 but less than $300,000 lower in value. This was reported by the Great Lakes Commission.

The substantial catch decline was due primarily to a lower alewife harvest in Lake Michigan. Excluding alewife, the 1968 catch was up about 2.8 million pounds from 1967 due to Canadian gains. U.S. landings of species other than alewives were about 40 million pounds for both years.

Particularly important in Canada's harvest are landings of yellow perch and smelt. The 1968 catch of perch from Province of Ontario waters was a record. In 1967 and 1968, this species was about half total weight of Canadian commercial catch; smelt landings were a quarter.

20 Species Commercially Important

About 20 species are netted by commercial fishermen in significant quantities--50,000 pounds or more annually. But of this group, 10 species provide most of the production and income for U.S. fishermen; Canadian lake fishermen rely heavily on 5 species.

Below are figures compiled by BCF Ann Arbor, Mich.

Catch & Makeup Vary Widely

The commercial catch varies widely for the several lake basins in size and composition. For combined U.S.-Canadian production, Lake Erie is normally the leader. But, in 1967, the top position went to Lake Michigan as a result of the exceptional catch of alewives; this brought Lake Michigan's share of Great Lakes total to 46%. However, the 1967 value of Lake Erie's U.S.-Canadian catch was $4.7 million, compared to slightly under $3 million for Lake Michigan.

In 1968, Lake Erie again became production leader. Catch rose to 51.3 million pounds, up 2 million over 1967; the lake remained first in value despite drop to $4.1 million.

	1967 (000 Lbs.)	1968 (000 Lbs.)	1967 (000 $)	1968 (000 $)
U.S. total	81,957	67,324	5,961	5,766
Lake Ontario	284	342	63	71
Lake Erie	11,615	11,921	1,326	1,165
Lake Huron	3,211	2,678	476	439
Lake Michigan	58,951	45,810	2,963	3,087
Lake Superior	7,895	6,573	1,133	1,004
Canadian total	45,646	48,340	4,834	4,746
Lake Ontario	1,832	2,010	243	284
Lake Erie	37,770	39,416	3,339	2,972
Lake St. Clair	810	1,122	200	271
Lake Huron	2,666	2,428	700	815
Lake Superior	2,568	3,364	351	404
U.S.-Canada total	127,603	115,664	10,795	10,512

	Pounds				Dollar Value			
	1967 (000s)	% of Total	1968 (000s)	% of Total	1967 (000s)	% of Total	1968 (000s)	% of Total
U.S. total	81,957	100	67,324	100	$5,961	100	$5,766	100
10-species	78,924	96	64,043	95	5,219	88	4,948	86
Alewives	41,895	51	27,194	40	447	7	280	5
Chubs	11,313	14	11,126	17	1,743	29	1,722	30
Carp	6,579	8	2,093	9	329	6	207	4
Yellow perch	5,778	7	5,267	8	715	12	621	11
Lake herring	3,831	5	3,663	5	433	7	423	7
Sheepshead	2,568	3	3,154	5	102	2	65	1
Smelt	2,776	3	3,115	5	95	2	98	2
Coho salmon	1,484	2	1,999	3	161	3	320	6
Whitefish	1,600	2	1,704	2	922	15	1,054	18
White bass	1,100	1	728	1	272	5	158	3
Canadian total	45,646	100	48,340	100	$4,834	100	$4,746	100
5-species total	39,588	87	42,265	87	3,983	82	3,846	81
Yellow perch	22,700	50	24,931	52	2,401	50	2,104	44
Smelt	12,660	28	12,490	26	508	10	486	10
Lake herring	1,924	4	2,715	6	90	2	166	3
Walleye	1,498	3	1,098	2	581	12	568	12
Whitefish	806	2	1,031	2	403	8	522	11

Canadian figures: Ontario Dept. of Lands & Forests.

Lake Michigan

In U.S. Great Lakes fishery, the Lake Michigan catch of 45.8 million pounds in 1968 was 68% of total compared to about 72% in 1967 record year (second table). The 1968 catch was nearly $3.1 million; it was the first $3-million year since 1958.

The Alewife

The alewife is found in all Great Lakes, but is sought by commercial fishermen only in Lake Michigan. There, the population recently became particularly high. In 1968, the catch was about 27.2 million pounds, or 14.7 million lower than 1967 record. However, it is a low-value species used for fish meal, oil, and pet foods. So this decline did not affect substantially the Lake Michigan catch value. In fact, the increase in dollar value of coho salmon, introduced into Great Lakes in 1966 and caught commercially only in Lake Michigan, was about equal to 1967-68 decline in value of alewife landings (first table).

The Chub

The chub is the most valuable commercial species in U.S. Great Lakes. Lake Michigan accounts for a large share. L. Michigan's yield rose from 9.1 million pounds in 1967 to about 10.2 million in 1968. For 1968, the value was $1.6 million, or 52% of total.

Yellow Perch

In contrast, the yellow perch catch in Lake Michigan presents a dismal outlook. The annual production of 4-5 million pounds in the early 1960s fell to new low of 632,000 in 1968. A significant cause was competition for food from the alewife, which has hampered perch in growing to marketable size.

OTHER LAKES

Lake Erie: U.S. catch in 1968 was only slightly above 1967's all-time low. Canadian 1967 & 1968 landings were among largest on record. This was due primarily to new yellow perch highs. This species ranks first in the commercial fishery on both sides of international boundary.

Lake Huron: U.S. landings were at a new low in 1968, only about half the early 1960s' figures. It was due to declines in some species--chub most noteworthy. Canadian production dropped substantially.

Lake Superior: The U.S. harvest in 1968 was lowest since early 1920s. This was due primarily to steady decrease in catch of lake herring: 3.7 million pounds compared to 10-11 million in 1950s. Canadian catch was highest since 1959.

Lake Ontario: The commercial fishery has remained stable. The annual catch usually amounts to somewhat over 2 million pounds. Canadian fishermen account for major share.

Lake St. Clair: The commercial fishery is limited to Canadian waters, where the harvest remains fairly stable. Walleye landings of 226,000 pounds in 1968 were worth close to half the dollar value of total catch.

FUR SEALS INCREASE AT CALIFORNIA ROOKERY

A new breeding colony of Northern fur seals on San Miguel Island off California has more than doubled since its discovery in July 1968 by scientists from the University of California and the Smithsonian Institution.

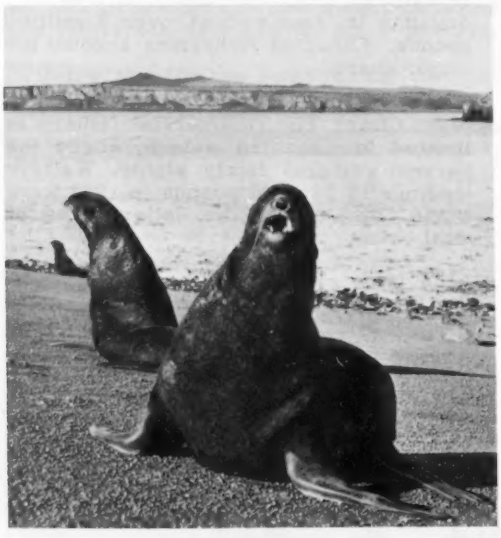
When the colony was found, there was a maximum of 86 fur seals. The herd was ruled by a lone "beachmaster," as a lordly breeding bull is called.

1969 Breeding Season

At the height of the breeding season in summer 1969, about 175 females were on the island. There were 4 adult bulls; 3 of them presided over harems.

There were fewer pups in 1969: only 26 compared with 36 in 1968. Reasons for the decline are unknown and BCF scientists will continue their study of the new colony.

Following their migratory habits, more than half the fur seals had left the island by early October 1969.



Fur seal bulls.

The Northern fur seal has a strong homing instinct. It usually returns to the rookery of its birth each year during the breeding season. Fur seals from other rookery islands were the main source of the increased population in 1969.

Santa Barbara Spill

Dr. Leslie L. Glasgow, Assistant Secretary of the Interior for Fish and Wildlife, Parks, and Marine Resources, said he was gratified to learn of the increased fur seal population. This was because of public concern for marine mammals expressed during the oil spill in Santa Barbara Channel in early 1969.

In June 1969, Interior Department reported no evidence that deaths of seals or sea lions on San Miguel Island could be attributed to oil pollution. In addition to fur seals, the island is inhabited by elephant seals, sea lions, some Stellar sea lions, harbor seals, and an occasional visiting Southern fur seal.

The Navy owns the island. Under an agreement with it, Interior's National Park Service has assumed responsibility for wildlife.

FISH SCHOOLS COUNTED BY SONAR FOR FIRST TIME

Fish schools were counted and measured in a 200,000-square-mile area off California and Baja, California, from BCF's 'David Starr Jordan.' This assessment of fish abundance is the first of its kind using sonar. The technique will yield a more exact assessment of the ocean's fishery resources.

A Million Schools

Data analyses indicate about one million schools of fish in the area. Most were about 66 feet in diameter, although a considerable number were much larger. A 66-foot school would yield an estimated 30 tons of fish. Many schools are probably young fish too small to catch. Other schools are northern anchovy, jack mackerel, bonito, Pacific mackerel and Pacific sardine of commercial size.

WOODS HOLE REPORTS ON 4-YEAR GAME-FISH TAGGING PROGRAM

Woods Hole (Mass.) Oceanographic Institution recently issued the results of a 4-year Cooperative Game Fish Tagging Program. The program's coordinator was Frank J. Mather III, Associate Scientist at the Institution.

Valuable information was provided by sport fishermen "leading to concern for the conservation of certain game fish species, primarily the bluefin tuna."

Biological Information Sought

The program's objectives are to obtain basic biological information that also can be used to manage fisheries. The game fish tagged are primarily tuna, marlin, sailfish, and amberjack. From 1965 until 1969, 18,193 fish were tagged--and 1,972 tags recovered and returned. Tagging exceeded the previous 11-year total of the program that started in 1954.

Mather says that "although the increased number of releases was very encouraging, the fivefold increase in the number of returns is much more important."

Bluefin Tuna

Bluefin tuna accounted for nearly 40% of all fish tagged and produced over 90% of the returns. This high return--plus a decline in commercial tuna catch--indicates bluefin stock is smaller than had been estimated and is being exploited very heavily. Based primarily on this program's results, FAO has recommended conservation of the species. It will discourage commercial fishing of bluefin weighing less than $22\frac{1}{2}$ pounds. The newly formed International Commission for the Conservation of Atlantic Tunas, recognized by 16 nations, will have authority to enforce the measures necessary to conserve tunas and billfishes.

Long Migrations

Two long migrations of giant bluefin were recorded. One tagged in the Bahamas in May 1967 was recaptured 50 days later off Bergen, Norway. This brings to 6 the transatlantic migrations of giant bluefin recorded by the program. Also recorded were 34 migrations of school bluefin tagged off Long Island (N.Y.) and Cape Cod (Mass.) and recovered in the Bay of Biscay. The annual variability of these migrations has a potential effect on western European fisheries. No westerly transatlantic migration of tuna has been recorded.

The longest liberty of a tagged tuna was recorded in August 1968 at Cape St. May's, Nova Scotia: a bluefin tagged south of Nantucket in November 1960. The fish required 8 years to increase from about 100 pounds to

405 pounds. It indicates that Woods Hole estimates of time required to replace stocks of giant tuna (based on growth studies) have been conservative.

White Marlin

Important progress was made in tracing white marlin migrations. "A definite cyclical migratory pattern has been established for those which furnish the summer fishing between Cape Hatteras and Cape Cod." Sufficient white marlin are being tagged in this area, but Woods Hole urges increased tagging in southern waters to clarify population identity and migratory patterns of other stocks. The first two recoveries of tagged blue marlin indicate that these great fish also can be tagged successfully.

Atlantic Sailfish

Atlantic sailfish tagging numbered 3,833; 45 were returned. "Although less dramatic than those for tuna or marlin, the results are of considerable interest." A sailfish marked off Jacksonville, Fla., in June 1969 and recaptured off Fort Lauderdale, Fla., in October 1969 was first direct proof of southward migration. It showed need for increased tagging in northern Florida-to-Cape Hatteras area to supplement these studies.

Striped Marlin

Striped marlin tagging in the Pacific is carried on jointly with the Tiburon Marine Laboratory of the Bureau of Sport Fisheries and Wildlife. A recently recovered WHOI tag indicates one of the longest recorded migrations for this species. A fish tagged off Catalina Island, Calif., was recaptured 2,000 miles away, about 975 miles north of the Marquesas Islands.

Greater Amberjack

Return rates for the greater amberjack have risen within the past 4 years, but fishing pressure does not threaten total population. There were several new record long-distance migrations. The amberjack is a very hardy fish and the death rate due to tagging is low; for this reason, "interesting new results may be expected."

Program Objectives

Objectives of the Woods Hole program center on identifying populations and determining effects of fisheries on them, especially bluefin tuna. "Methods include increased tagging of baby bluefin tuna, particularly in southern waters, increased tagging of white marlin in southern waters, and of sailfish and greater amberjack in the northern parts of their ranges. Harpoon tagging of free-swimming fish appears to offer great possibilities for increased tagging of giant bluefin and swordfish."

FOREIGN FISHING OFF U.S., OCTOBER 1969

NORTHWEST ATLANTIC (Fig. 1)

During October, 256 individual foreign fishing and support vessels were sighted (340 in Sept. 1969; 177 in Oct. 1968). Number decreased from about 240 early in month to about 100 at month's end, a normal decrease for this season.

USSR: 62 medium side trawlers, 34 factory stern trawlers, 2 factory base ships, 6 refrigerators, 2 tankers, and 1 tug. Early in month, about 100 were along 30-fathom curve from 35 miles south of Shinnecock Inlet, L.I., to 30-40 miles south and east of Nantucket. At mid-month, from Cultivator Shoals to Northern Edge, Georges Bank; at month's end, about 60 vessels remained centered south of Martha's Vineyard and Nantucket. Principal catches were herring and mackerel (south of

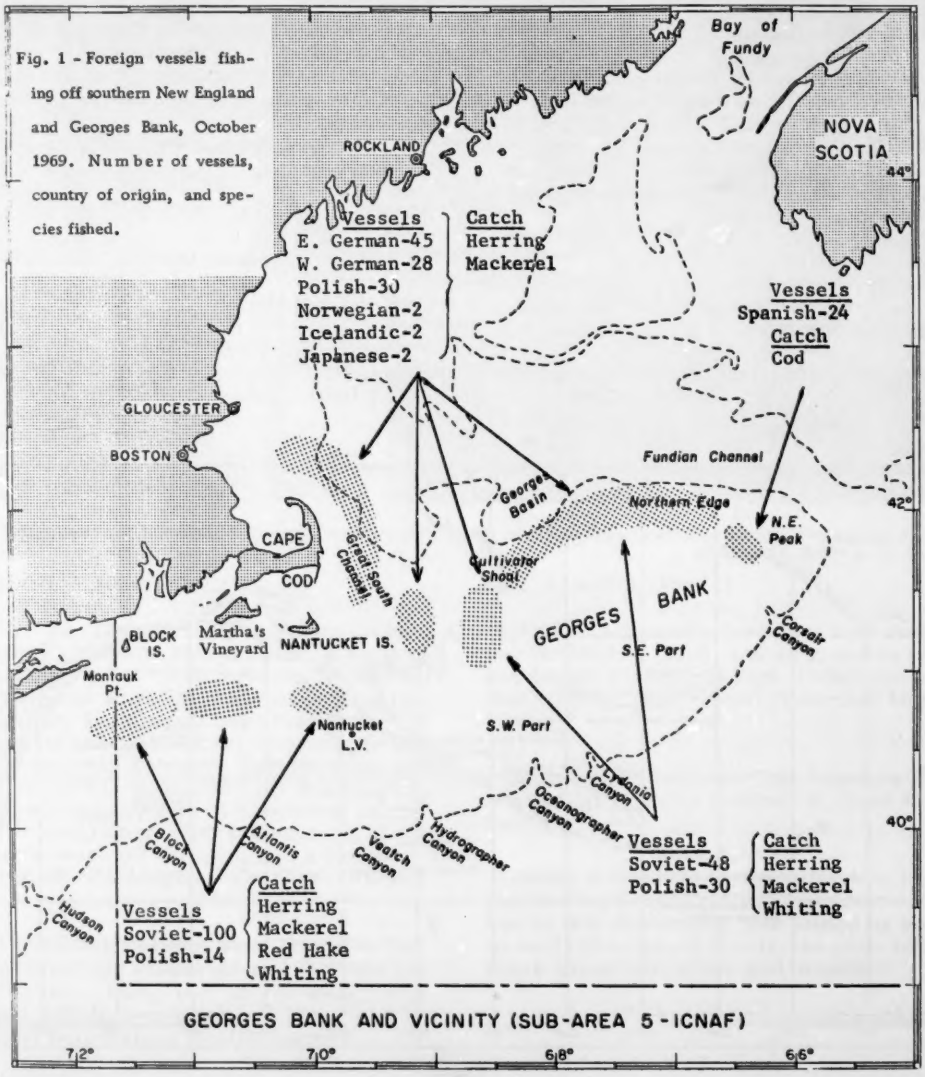


Fig. 1 - Foreign vessels fishing off southern New England and Georges Bank, October 1969. Number of vessels, country of origin, and species fished.

Nantucket and on Georges Bank), red hake (south of Montauk Point, Long Island), and whiting.

Poland: 32 large side trawlers, 7 stern trawlers, 2 factory base ships, and 3 carriers (50 in Sept. 1969; 23 in Oct. 1968). Along Georges Bank from Cultivator Shoals to Northern Edge, early in month; east and south of Nantucket after mid-month. Moderate-to-heavy catches of herring and mackerel. Some red hake south of Nantucket.

East Germany: 32 factory and freezer stern trawlers, 11 side trawlers, and 2 factory base ships (50 in Sept. 1969; 38 in Oct. 1968). East of Cape Cod and Nantucket to northern slopes of Georges Bank early in month; none sighted late in month. Moderate catches of herring.

West Germany: 28 stern trawlers (29 in Sept. 1969; 35 in Oct. 1968). Fished same areas as East Germans early in month; none sighted late in month.

Spain: 24 stern and side trawlers, pair-trawling early in month; none sighted late in month.

Japan: 2 stern trawlers sighted among foreign fleets on Northern Edge of Georges Bank.

Iceland: 6 herring purse seiners that had been operating out of Gloucester, Mass., departed during first-half October.

Norway: 2 medium purse seiners and 1 large seiner, based at Gloucester, replaced Icelandic seiners. Herring catches were only fair. One large seiner on Georges Bank departed because of poor catches.

GULF OF MEXICO & SOUTH ATLANTIC

No foreign fishing vessels observed in October.

OFF CALIFORNIA

USSR: One medium trawler, about 20 miles out, near Oregon border. Catch: probably black cod or hake.

Japan: One stern trawler underway, not fishing. R/V 'Kaiyo Maru,' en route to Southwest Atlantic, called at San Diego, October 25-30.

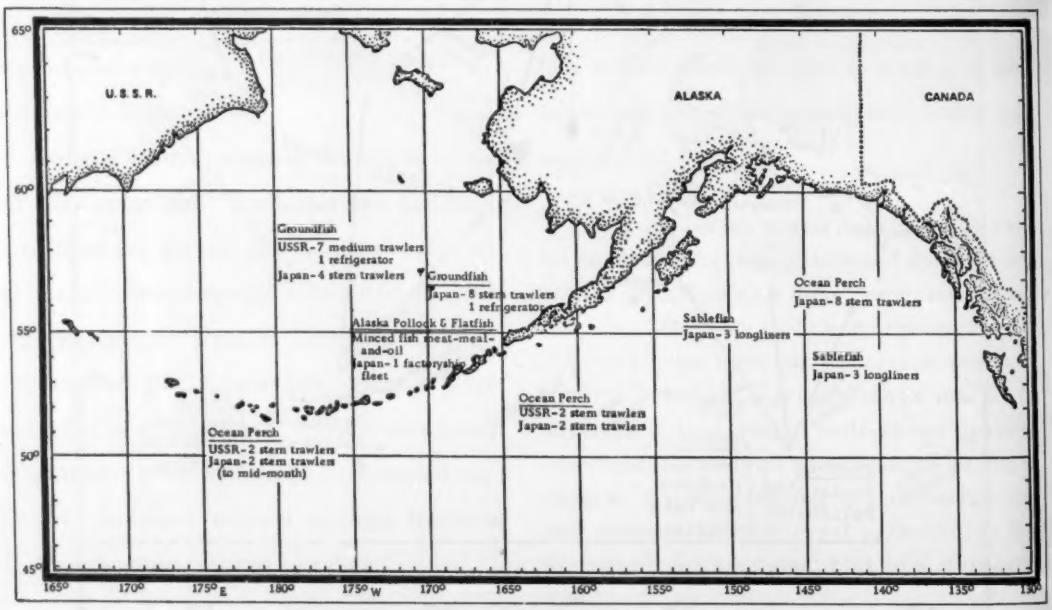


Fig. 2 - Soviet & Japanese fisheries off Alaska, October 1969.

Fig. 3 - Fishermen aboard BCF's 'Miller Freeman' operating in Bering Sea prepare to inspect their experimental drag catch as a Japanese fishing vessel crosses their stern. (BCF-Alaska photo: J. M. Olson.)

OFF PACIFIC NORTHWEST

USSR: 21 large stern freezer and factory trawlers, 1 medium side trawler, 6 support vessels, and 3 research vessels. About 10 stern trawlers 40 miles WNW of Destruction Island and 16-60 miles off Cape Flattery early in month (10-15 believed off Oregon). In 2nd week, 18 vessels between Yaquina Head and Cape Blanco off Oregon, a few off Washington, and a small group south of Vancouver Island on La Perouse Bank. After mid-month, about 25 vessels were off Oregon, and a few were scattered off Washington. Catches: Pacific hake.

The research vessels were from the Pacific Institute for Fisheries and Oceanography (TINRO). One, the SRTM 8437, was equipped with high-intensity lights, and may have been test-fishing Pacific saury.

OFF ALASKA (Fig. 2)

USSR: 12 vessels, less than half the number in October 1968, and as many as in July and August 1969 (17 in Sept. 1969); the fewest since Soviet year-round fisheries began in 1963.

Japan: The decrease that began in August leveled off in early October at about 40 vessels.

South Korea: A stern trawler that had begun fishing Alaska pollock in eastern Bering Sea in late September was joined by another in early October. It is believed both returned home some time after mid-month.

ARTICLES

FORECASTING WORLD DEMAND FOR TUNA TO THE YEAR 1990

Frederick W. Bell

Total world demand for tuna continues to increase rapidly due to rising populations and expanding per-capita income in the principal tuna-consuming countries, such as the U.S., Japan, and members of the European Economic Community (EEC). EEC comprises Belgium, Luxembourg, France, West Germany and the Netherlands.

Taking into account expected increases in population and standard of living (per-capita income) over the next 20 years, we have forecast that world tuna consumption would approach 5 million metric tons by 1990 if supplies were available. However, this is not possible because maximum sustainable yield of known tuna resources in the world is estimated to be no more than 2.6 million metric tons.

To match consumption with available supplies, it is likely that prices of tuna will increase appreciably in the next 20 years. The increasing pressure of demand makes it especially necessary to consider sound management schemes to reduce the possibility of overfishing and destroying the world's tuna resources.

During recent years, the world demand for tuna has increased rapidly. Tuna and tuna-like fish in this article include: albacore, bigeye, bluefin, bonitos, frigate mackerels, little tunas, skipjack, yellowfin, and tuna-like species.

According to the Food and Agriculture Organization of the United Nations, total world consumption of tuna and tuna-like species (in round weight) increased from 804,700 metric tons in 1956 to 1,330,000 metric tons in 1967. The consumption of raw and canned tuna by selected countries during 1955-66 is shown in Table 1.

If the world demand for tuna continues to increase over the next few decades, as expected, there is serious question whether the world's oceans can provide for this rising consumption. So it becomes increasingly important to have adequate knowledge regarding the demand for tuna over the next 20 years. Forecasts of demand can be used to predict when demand will equal or surpass supply. This has practical significance to all agencies involved in fishery policy and programs, to the commercial fishing industry, and to the public.

For fisheries experiencing added pressure on existing stocks, economic forecasts, plus biological forecasts, can provide basis for identifying areas of potential pressure on prices, and indications of other market adjustments that may take place. Such forecasts also underscore the need for improved management policies.

Dr. Bell is Chief, Division of Economic Research, BCF. This project is part of a Division study on forecasting world demand for fishery products.

U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Sep. No. 856

Table 1 - Consumption of Raw and Canned Tuna by Selected Countries, 1956-1966
(Raw is fresh and frozen tuna. Canned has been converted to round-weight basis by increasing it 100 percent.)

Country and degree of processing	1956	1958	1960	1962	1964	1966	1966 as % of total
	------- Thousand metric tons, round weight ----------						percent
U.S.A.							
canned	240.6	281.0	336.2	333.8	350.4	382.8	29.0
Japan							
raw	157.9	217.3	190.6	303.3	243.8	353.0	26.7
canned	48.4	46.8	46.0	39.0	31.8	25.8	2.0
Total	(206.3)	(264.1)	(236.6)	(342.3)	(275.6)	(378.8)	(28.7)
EEC							
canned	71.0	85.2	130.0	142.8	153.8	159.0	12.0
Spain							
raw	5.0	14.0	12.2	17.8	21.5	31.8	2.4
canned	29.0	37.0	25.2	28.4	25.8	37.8	2.9
Total	(34.0)	(51.0)	(37.4)	(46.2)	(47.3)	(69.6)	(5.3)
Peru							
raw	33.0	33.9	59.0	58.6	80.0	50.2	3.8
China (Taiwan)							
raw	16.1	18.5	15.8	29.2	25.0	38.0	2.9
canned	0.6	1.4	1.4	3.0	7.2	6.8	0.5
Total	(16.7)	(19.9)	(17.2)	(32.2)	(32.2)	(44.8)	(3.4)
Turkey							
raw	53.7	25.3	31.7	3.8	11.2	16.0	1.2
Canada							
canned	5.3	4.6	6.9	8.2	8.5	10.2	0.8
U.K.							
canned	12.0	5.6	4.2	5.4	7.8	7.6	0.6
Other							
raw	64.0	130.0	149.8	186.4	160.5	89.0	6.7
canned	68.1	54.4	48.1	83.4	84.7	112.0	8.5
Total	(132.1)	(184.4)	(197.9)	(269.8)	(245.2)	(201.0)	(15.3)
Total							
raw	329.7	439.0	459.1	599.1	542.0	578.0	43.8
canned	475.0	516.0	598.0	644.0	670.0	742.0	56.2
Total	804.7	955.0	1057.1	1243.1	1212.0	1320.0	100.0

Source: Original data from 'FAO Yearbooks of Fishery Statistics' compiled by Liaqat Ali, "World Raw and Canned Tuna Situation," 'Commercial Fisheries Review,' Fish and Wildlife Service, Vol. 30, No. 2, Feb. 1968, pages 24-31.

Table 1A - Data Related to U.S. Demand for Canned Tuna

Year	Per capita consumption of canned tuna	Wholesale price: canned tuna	Wholesale price: canned salmon	Per capita disposable personal income	Consumer price index for meat, fish and poultry	Wholesale price index	Consumer price index
	pounds	cents per pound		dollars	1957-59 = 100		
1947	0.78	78.4	44.5	1,179	84.8	81.2	77.8
1948	0.89	81.7	52.0	1,290	96.2	87.9	83.8
1949	0.89	69.3	39.0	1,264	91.1	83.5	83.0
1950	1.13	64.6	52.9	1,364	95.1	86.8	83.8
1951	1.22	63.1	48.7	1,468	106.1	96.7	90.5
1952	1.27	63.4	45.9	1,518	105.3	94.0	92.5
1953	1.37	67.2	43.8	1,582	99.6	92.7	93.2
1954	1.37	66.4	46.2	1,585	97.6	92.9	93.6
1955	1.43	63.7	51.6	1,666	92.1	93.2	93.3
1956	1.57	61.2	56.5	1,743	88.0	96.2	94.7
1957	1.58	58.4	55.9	1,803	95.4	99.0	98.0
1958	1.77	58.4	51.8	1,831	104.4	100.4	100.7
1959	1.88	56.4	60.7	1,905	100.4	100.6	101.5
1960	2.05	57.3	64.9	1,937	99.1	100.7	103.1
1961	2.08	60.9	66.0	1,983	99.3	100.3	104.2
1962	1.97	62.5	58.5	2,064	101.7	100.6	105.4
1963	1.98	61.7	55.6	2,136	100.2	100.3	106.7
1964	2.01	62.2	53.1	2,280	98.6	100.5	108.1
1965	2.32	65.0	70.4	2,432	105.1	102.5	109.9
1966	2.20	68.5	64.6	2,598	114.1	105.9	113.1
1967	2.32	67.3	73.6	2,744	111.2	106.1	116.3

Source: U. S. Department of the Interior, U. S. Department of Commerce, and U. S. Department of Labor.

FACTORS BEHIND DEMAND FOR CANNED TUNA: U.S. EXPERIENCE

Expressed in round weight, U.S. per-capita consumption of canned tuna increased from 1.56 pounds in 1947 to 4.64 pounds in 1967. What are the factors behind this rapid increase? A statistical analysis was made in which the following factors were related to per-capita consumption of canned tuna:

1. Wholesale price of canned tuna relative to general price level in U.S. economy.

2. Per capita disposable personal income relative to general price level in U.S. economy (standard of living).

3. Wholesale price of canned salmon relative to general price level.

4. Retail price of meat, poultry, and fish as category relative to general price level.

The hypothesis concerning these relationships was: If canned tuna prices go up, per-capita consumption would fall because consumers would substitute other foods or goods for tuna; if per-capita income increases, per-capita consumption of canned tuna would rise because consumers would have a higher standard of living and could enjoy more tuna; if the price of canned salmon were to increase relative to tuna, this would increase canned-tuna consumption as consumers switched from salmon to tuna; and, finally, if the price of meat, poultry, and fish as a category went up relative to tuna, consumers would eat more canned tuna. What did we find?

For the U.S. during 1947-67, per-capita consumption of canned tuna was influenced primarily by the price of canned tuna and per-capita income. The price of canned salmon and the price of meat, poultry, and fish as a category were not statistically important. Figure 1 shows the estimating accuracy of our statistical equation. This related U.S. per-capita consumption of canned tuna to canned tuna prices, per-capita income, canned salmon prices, and the price of meat, poultry, and fish as a category. The estimating accuracy of our equation is very good over the 1947-1967 period.

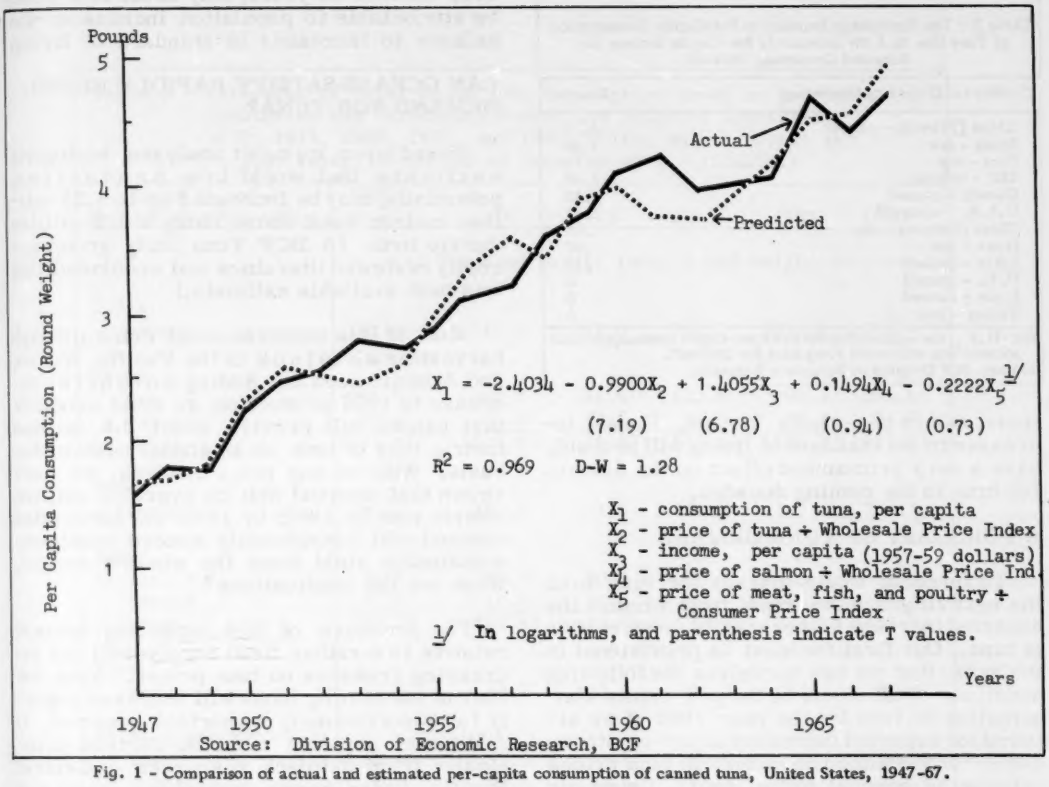


Fig. 1 - Comparison of actual and estimated per-capita consumption of canned tuna, United States, 1947-67.

According to the analysis, a 10% increase in tuna prices would reduce tuna per-capita consumption by approximately 10%. However, a 10% increase in per-capita income would increase per-capita consumption of canned tuna by about 14%. These quantitative relationships allow prediction of the impact of, for example, a 50% increase in per-capita income, or a 20% rise in price of canned tuna on per-capita consumption. These are very important relationships that must be known before reliable forecasts can be made.

DEMAND FACTORS FOR RAW AND CANNED TUNA ABROAD

Analyses of demand factors similar to those carried out for the U.S. were applied to Japan, EEC countries, Spain, Peru, China (Taiwan), Turkey, Canada and the United Kingdom. These and the U.S. account for about 85% of world consumption of tuna. The demand for tuna was divided into raw and canned in some countries where both forms are a significant percentage of consumption. Because of the lack of statistical importance of salmon prices, and meat, fish, and poultry prices found in the U.S. analyses--and the difficulty of obtaining data for other countries--these factors were omitted from the statistical analyses.

For the countries studied, the results indicated that per-capita income and tuna prices were significant factors in explaining changes in per-capita consumption of tuna over the last 11 years. Table 2 shows the percentage response of tuna per-capita consumption in the various tuna-consuming countries to a 1% increase in per-capita income. Of special interest, such culturally similar countries as Canada, the U.S., and EEC members have nearly the same response of per-capita consumption of canned tuna to changes in per-capita income. Only a few countries showed a decline in per-capita tuna consumption with

Table 2 - The Percentage Increase in Per-Capita Consumption of Tuna Due to A 1% Increase in Per-Capita Income for Selected Countries, 1956-66

Country and Degree of Processing	Percent
China (Taiwan) - canned	4.76
Spain - raw	1.85
Peru - raw	1.76
EEC - canned	1.47
Canada - canned	1.45
U.S.A. - canned*	1.41
China (Taiwan) - raw	.85
Japan - raw	.57
Spain - canned	.38
U.K. - canned	0
Japan - canned	0
Turkey - raw	0

*For U.S., the relationship between per-capita consumption and income was estimated using data for 1947-67.
Source: BCF Division of Economic Research.

increases in per-capita income. Hence, increases in the standard of living will probably have a very pronounced effect on the demand for tuna in the coming decades.

A FORECAST OF TUNA DEMAND

To forecast world market for tuna over the next 20 years, we must first predict the expected increase in per-capita consumption of tuna. Our first forecast is provisional in the sense that we ask ourselves the following question: What would be the per-capita consumption of tuna by the year 1990 if we allowed for expected increases in per-capita income--and assumed no change in tuna prices relative to general price level? Using our statistical relationships developed above--with U.S. Department of Agriculture projections to 1990 of per-capita income for principal tuna-consuming countries--we made a forecast of per-capita consumption of tuna. Then, this was multiplied by the population expected to exist by 1990 to obtain the forecasted tuna market.* These provisional forecasts are shown by country in Table 3.

Based on expected increases in population and standard of living (per-capita income), world consumption is expected to reach about 2.8 million metric tons by 1980, and 5 million metric tons by 1990. This is shown in Figure 2 as projection A. In other words, world tuna consumption is expected to double in each of the next two decades--assuming world supplies are adequate and there is no rise in tuna prices. Further, the analysis showed that of the expected increase in tuna demand over the next 20 years, only about 10% would be attributable to population increases--the balance to increases in standard of living.

CAN OCEANS SATISFY RAPIDLY RISING DEMAND FOR TUNA?

Based upon recent analyses, biologists estimate that world tuna production, potentially, may be increased up to 1.25 million metric tons above today's 1.3 million metric tons. (A BCF Tuna Study group recently reviewed literature and concluded this was best available estimate.)

Most of this increase must come through harvesting skipjack in the Pacific, Indian, and Atlantic oceans. Adding potential increase to 1966 production, we must conclude that nature will provide about 2.6 million metric tons of tuna on an annual sustainable basis. Without any price changes, we have shown that demand will be over 2.8 million metric tons by 1980; by 1990, the forecasted demand will considerably exceed maximum sustainable yield from the world's oceans. What are the implications?

The pressure of this expanding demand relative to a rather fixed supply will put increasing pressure on tuna prices. Also, the cost of harvesting tunas will increase rapidly for two extremely important reasons: 1) Additional supplies must be derived principally from skipjack resources of Central Pacific; under known technology, these are extremely difficult to find and harvest. 2) Increased fishing effort on tuna resources in general probably will reduce catch per unit of effort. This would increase cost per pound of fish landed.

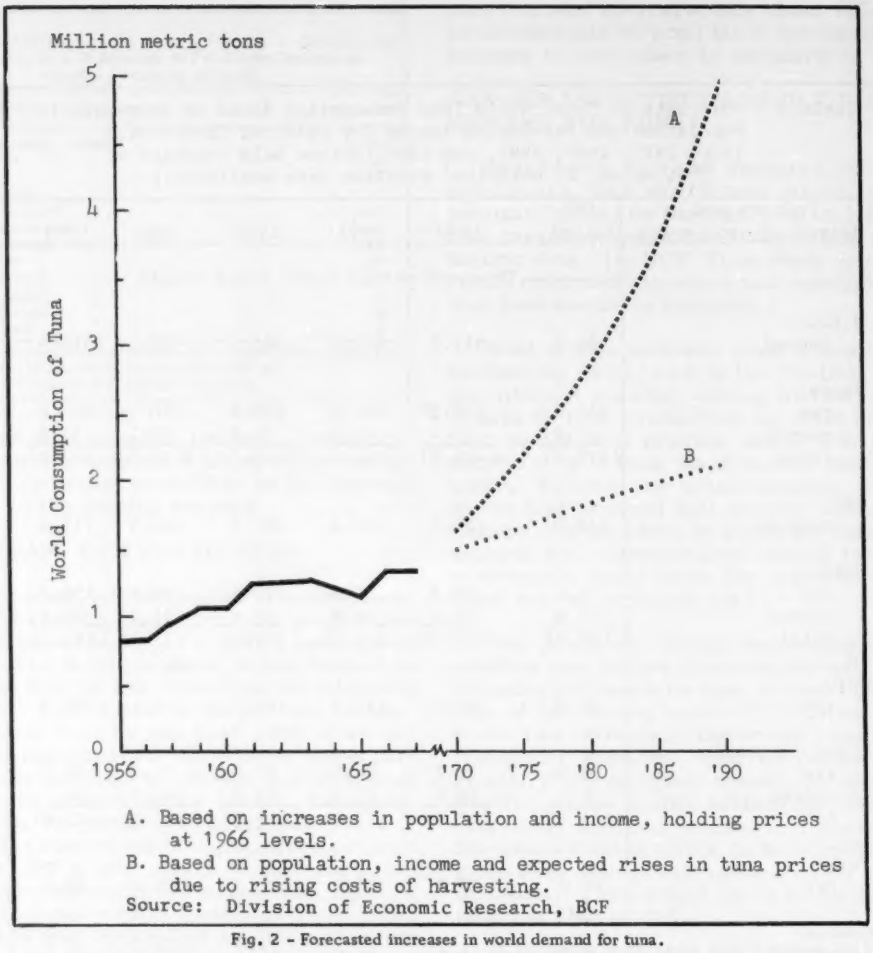
It is quite probable that prices and cost of tuna will double by 1990. For an increase in tuna prices to reduce consumption, it is necessary that these increase more rapidly than general price level. More precisely, we are forecasting that prices of tuna relative to general price level will double by 1990.

The higher price of tuna will reduce consumption. At the higher prices, it is forecasted that world production and consumption of tuna will be equal at about 2.1 million metric tons by 1990. This is shown in Figure 2 in projection B. If we forecast tuna demand to the year 2000, the results indicate tuna prices will probably triple--and that production

*The sum of individual forecasts for each of the 9 country categories was increased by the average percent for rest of world's tuna consumption during 1956-1966. Population forecasts were obtained from U.S. Department of Agriculture.

Table 3 - Forecasts of Total World Tuna Consumption Based on Increases in Population and Per-Capita Income for Selected Countries, 1970, 1975, 1980, 1985, and 1990 (Prices held constant at 1966 value, if unlimited supplies were available.)

Country and degree of processing	1966 Actual	1970	1975	1980	1985	1990
	-------- Thousand metric tons, round weight ---------					
U.S.A.						
canned	382.8	511.3	671.6	845.3	1055.8	1318.4
Japan						
raw	353.0	382.2	486.9	620.6	790.1	1005.6
canned	25.8	26.4	27.6	28.9	30.2	31.6
total	(378.8)	(408.6)	(514.5)	(649.5)	(820.3)	(1037.2)
EEC						
canned	159.0	210.5	281.4	382.8	522.5	713.4
Spain						
raw	31.8	30.3	50.5	73.1	105.8	153.2
canned	37.8	19.1	21.9	24.4	27.3	30.5
total	(69.6)	(49.4)	(72.4)	(97.5)	(133.1)	(183.7)
Peru						
raw	50.2	98.7	137.3	194.7	275.1	387.4
China (Taiwan)						
raw	38.0	35.1	44.1	56.0	71.0	90.3
canned	6.8	12.8	27.7	63.7	146.0	334.7
total	(44.8)	(47.9)	(71.8)	(119.7)	(217.0)	(425.0)
Turkey						
raw	16.0	17.9	20.6	23.5	26.9	30.7
Canada						
canned	9.7	11.6	15.2	19.5	25.0	32.1
U.K.						
canned	7.6	7.4	7.8	8.0	8.3	8.6
Total - selected countries	1118.5	1363.3	1792.6	2340.5	3084.0	4136.5
Grand total (Projected at 120% of total for selected countries.)	1320.0	1636.0	2151.1	2808.6	3700.8	4963.8



A. Based on increases in population and income, holding prices at 1966 levels.
B. Based on population, income and expected rises in tuna prices due to rising costs of harvesting.
Source: Division of Economic Research, BCF

Fig. 2 - Forecasted increases in world demand for tuna.

and consumption will equal maximum sustainable yield for world's tuna resources. This implicitly assumes that as each tuna stock reaches maximum sustainable yield, a regulatory authority is able to prevent overfishing.

A NEED FOR POLICY

We must point out some critical facts. First, tuna demand is extremely strong and is likely to expand greatly over the next 20-30 years. Second, without any increases in tuna prices, consumption would likely exceed the oceans' potential production by a ratio of two to one by 1990--and, possibly, by five to one by 2000. These events will put great upward pressure on tuna prices. Such price increases would relieve demand pressure on fixed and relatively scarce tuna resources by discouraging further consumption increases. Most probably, the mushrooming demand will turn tuna into a luxury good.

The need for policy is unmistakable. With increasing pressure on tuna resources, the possibility of overfishing looms--unless there are significant breakthroughs in other areas, such as tuna aquaculture. A vigorous program of world management must be instituted to avert resource destruction.

Already, the Inter-American Tropical Tuna Commission and the Atlantic Tuna Commission are engaged in this effort. But the astounding pressure of world demand adds urgency to the need for more effective global management than the present scheme permits.

Our forecasts are tentative. We may have to adjust or refine these further when more information on tuna consumption becomes available. For example, the response of tuna consumption to income may diminish over time and dampen, somewhat, the projections. However, at the present time, these estimates are the best available--and certainly useful in identifying areas of concern and in underlining the need for action.

HOW ARE OCEANOGRAPHIC OBSERVATIONS TAKEN BESIDE FROM A SHIP?

Because oceanographic ships are expensive to operate, difficult to anchor in deep water, and limited in speed, continuous observations in one location and surface observations over wide ocean areas can best be accomplished by means other than ships.

Buoys have been used for many years to obtain measurements of surface and subsurface currents and temperatures, as well as to observe meteorological conditions. These observations were mostly made near shore because of the difficulties in deep-sea anchoring and long-distance radio transmission. More recently other measurements have been included, such as of salinity and waves.

There is increasing interest in setting up networks of moored buoys which would transmit oceanographic and meteorological information by radio or satellite relay. The NOMAD (Navy Oceanographic Meteorological Automatic Device) buoys have withstood hurricanes and therefore supplied timely and useful data which could not have been collected by ships.

FLIP (Floating Instrument Package) is a hybrid ship-buoy. It is towed in the horizontal position to its location, where ballast tanks at one end are flooded, thus flipping it to the vertical position. FLIP serves as a stable, manned platform or "buoy" with observation ports extending to a depth of about 300 feet.

Offshore towers have also been used for collection of oceanographic data. Some, such as the Navy Electronics Laboratory tower located a mile off the San Diego, California, coast, have been built specifically for oceanographic research; others, such as the Air Force radar towers (Texas towers), were built for other purposes but also used as observation sites by oceanographers. The Coast Guard is undertaking a significant and extensive oceanographic data collection program on its new offshore towers. These towers, which replace the lightships as outer channel markers to major East Coast and West Coast ports, are being equipped with an impressive array of oceanographic instruments.

Surface data, primarily temperature, have been collected by extremely sensitive sensors on aircraft and satellites. Frequent flights have made it possible to map the meanderings of the Gulf Stream.

Subsurface observations have been made by submersibles and by divers operating either from the surface or from underwater laboratories. ("Questions About The Oceans," U.S. Naval Oceanographic Office.)

REARING LARVAL TUNAS IN THE LABORATORY

Edward D. Houde and William J. Richards

Despite the extensive high-seas fisheries for the several species of tunas, little is known about the early life of these fishes. One of the objectives of the Life History Studies Program at BCF's Tropical Atlantic Biological Laboratory (TABL) is to solve problems that biologists encounter in working with eggs and larvae of tunas. We hope to rear successfully tuna larvae from fertilized eggs--and to describe the egg and the development of the species from hatching to the juvenile stage. At present, tuna larvae caught at sea are difficult to identify with certainty because of the similarity in appearance among tuna species. We hope also to determine growth rates and mortality rates of tuna larvae reared in the laboratory and to investigate factors that may have an important influence on survival. If the effects on larval survival of physical and biological factors can be evaluated, then useful predictions of future recruitment to tuna stocks in the open sea may be possible--through the use of indices of larval abundance, and measurements of such environmental variables as temperature, salinity, and availability of potential food for tuna larvae.

Obtaining Eggs and Embryos

Tunas are seldom caught when they are ready to spawn. Attempts made by TABL biologists to artificially fertilize tuna eggs on research cruises have been unsuccessful. Kume (1962) has reported the only known successful fertilization of tuna eggs. Two larvae of the bigeye tuna, Thunnus obesus, hatched in his experiments--but survived less than one day. Because we could not obtain adult spawners at TABL, we collected planktonic fish eggs in the Straits of Florida hoping that some tuna eggs might be present and that they might then be hatched in the laboratory.

Eggs were collected from May through August 1969 in the western edge of the Gulf Stream near Miami, Florida (Fig. 1). A 1-m. plankton net was towed at the surface where the pelagic eggs of many species of fish drift until they hatch. Collections were brought to the laboratory and an attempt was made to sort the eggs by type. Then eggs were incubated and the larvae were reared. Examination of larvae that hatched from eggs collected in May 1969 showed that we had successfully hatched, and reared to 12 days past hatching, larvae that we identified later as those of the little tuna, Euthynnus alletteratus (Fig. 2). This was the first time tuna were reared past the yolk sac stage under laboratory conditions.

Fig. 1 - Area where eggs of the little tuna were collected. The eggs were hatched and reared in the TABL laboratory at Miami.

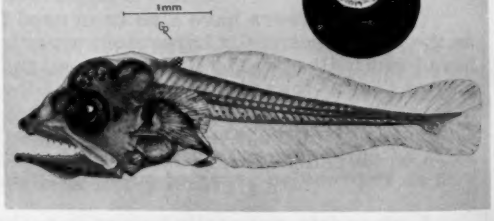


Fig. 2 - Twelve-day-old larva of the little tuna reared in laboratory.

The authors are biologists with BCF Tropical Atlantic Biological Laboratory, Miami, Florida 33149.

Note: See also "Larval Tuna Fish Reared for First Time," COMMERCIAL FISHERIES REVIEW 31(6):7(June 1969).

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Rearing Methods

Success in rearing tuna larvae beyond the yolk sac stage was achieved by using two slightly different methods. In the first, eggs were incubated in 20-gal. aquaria to which a dense culture of Chlorella was added to induce a "bloom" in the tank. We had known from previous experience that the likelihood of success in rearing pelagic fish larvae in small tanks increased by the Chlorella, but its role in promoting success is still unclear. In the second method, to vary the experiment, incubation and rearing were attempted in a 140-gal., round, fiberglass tank to which no Chlorella was added. Both tanks were aerated and circulated by compressed air provided through airstones. Water temperature was held at approximately 26° C. Lights were left on continuously in all tuna-rearing experiments.

Tuna larvae hatched within 12 hrs. of collection, probably within 24 hrs. after the eggs were spawned in the Gulf Stream. The larvae were slightly less than 3 mm. long at hatching and had a large yolk sac with a single, prominent oil globule. The eyes were unpigmented and no functional mouth or gut was present. Within 48 hrs. after hatching, the yolk was absorbed, larvae had developed pigmented eyes, and mouth and gut were functional. Food was added to the tanks at this time.

The food on which larvae of the little tuna began to feed was zooplankton collected in Biscayne Bay by a 35-micron mesh plankton net. For the first 3 days, only plankton less than 100 microns in body width was fed to the larvae, but larger organisms were offered to older larvae. Most of the food provided consisted of copepod nauplii and copepodites. Larvae in the 20-gal. aquaria and the 140-gal. tank accepted this food. Tuna larvae were very active in their search for food, and feeding rates were higher than those of many other fish larvae that we have reared.

The growth of larvae in our experiments probably was not as fast as in the natural environment. Though larvae fed well for about the first 10 days after hatching, the condition of most larvae then deteriorated. The growth in length for one rearing experiment is shown in Figure 3. Slow growth may have been due to a gradual increase in metabolites or bacterial contamination in the rearing tanks. We suspect that the behavior of larvae also may have been altered under tank conditions because most older larvae would not accept as food the larger zooplankton which has been observed in the guts of ocean-collected larvae. Twelve days after hatching, some larvae did accept brine shrimp (Artemia salina) nauplii, but the larvae would not eat large zooplankton or other larval fish.1/

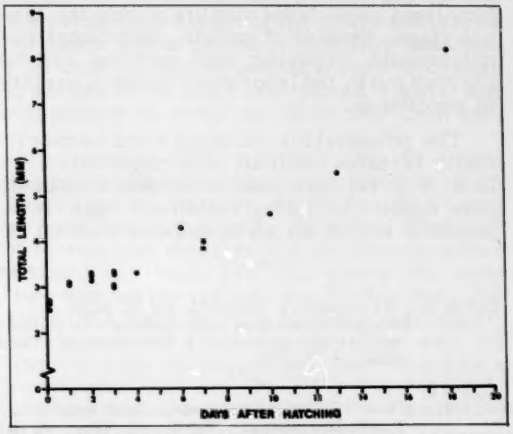

Fig. 3 - Growth in length of little tuna larvae reared in laboratory.

Larvae of the little tuna have not survived beyond 18 days after hatching in any of our experiments from May through July 1969. Causes for the complete mortalities are still unknown. About half our attempts failed because larvae did not initiate feeding and died shortly after absorption of the yolk. The percentage of successes was higher in the 140-gal. tank than in 20-gal. tanks; this suggests that the larger volume of water was beneficial to rearing. No rearing attempts were successful in 20-gal. tanks without a bloom of Chlorella, although larvae fed readily in the 140-gal. tank without Chlorella. One source of mortality undoubtedly was the presence of food at a density other than the optimum. Too little food could have caused starvation of the larvae, but too great an amount could have polluted the rearing tanks in a few days. The effects of food density and feeding rates on survival of tuna larvae are critical problems yet to be solved.

1/Charles Mayo, School of Marine and Atmospheric Sciences, University of Miami, recently succeeded in rearing the little tuna to more than 20 mm. long, and larvae of bullet mackerel (Auxis sp.) to about 12 mm. His larvae accepted larger food and growth was faster than in our experiments.

Potential for Rearing

Tunas probably can be reared beyond the larval stage in sufficient quantity for experimental purposes. Techniques still need to be improved. But the major obstacle in culturing pelagic larvae of marine fishes--failure of larvae to initiate feeding--does not seem as great a problem for tuna larvae (at least for the little tuna) as it is for larvae of many other fishes that we have attempted to rear. Experimental rearing of tunas offers an exciting opportunity to study many critical problems associated with life during the larval stage. Studies of growth, nutritional requirements, behavior, and survival can be carried out in the laboratory under a variety of conditions.

The potential for culturing tunas commercially remains unclear. One problem is the lack of a reliable and continuous source of tuna eggs. Collecting fertilized eggs in a plankton net is an undependable method of obtaining large numbers. Catches at sea of adult tunas ready to spawn are rare. This precludes the possibility of artificially fertilizing their eggs. Recent successes in maintaining adult tunas in captivity (Nakamura, 1962; Inoue et al, 1967) suggest that hormone injections might be used to stimulate these captive fish to spawn. Because adult tunas are among the most difficult of fishes to handle without causing mortality, however, the repeated handling now necessary when using hormone injections may be impossible for successful spawning of tunas and tunalike fishes.

Other problems to be solved include providing large quantities of animal food, and the large volume of good water required by fast-growing and active tunas. Some of our laboratory-rearing experiments may help to determine whether these problems can be overcome and, if so, whether tunas can be reared on a commercial scale.

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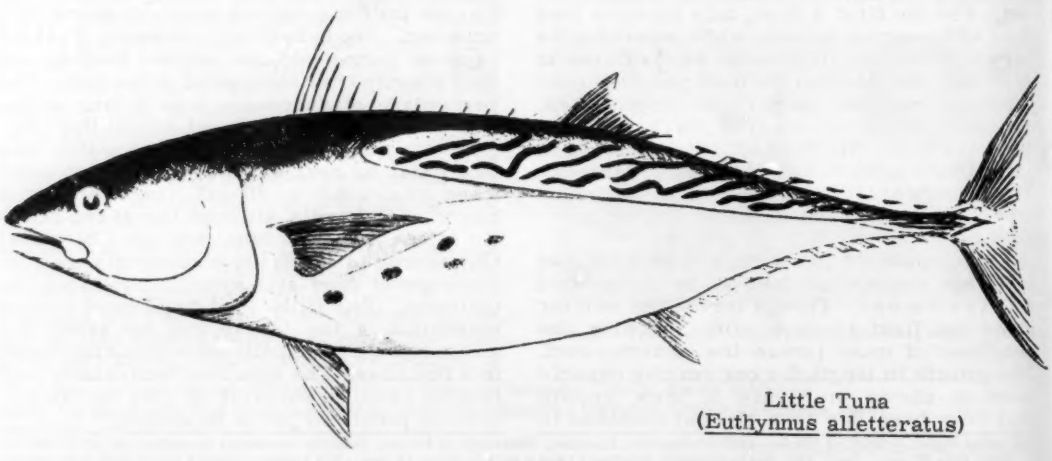

Little Tuna
(Euthynnus alletteratus)

FISHERY OCEANOGRAPHY--V

OCEAN CIRCULATION AND DISTRIBUTION OF SOCKEYE SALMON

Felix Favorite

Early in this century, sealers frequently encountered a change in water color and an increase in sea birds and fur seals south of Attu Island, Alaska (near lat. 50° N., between long. 173° E. and 180°). The sealers believed these conditions were caused by a shallow bank. It was not until 1936 that forerunners of modern acoustic sounding devices showed that the ocean depths throughout this area not only exceed 3,500 meters but, in some places, 7,000. More than two decades later, the phenomenon was attributed to a westward intrusion of coastal water from the Gulf of Alaska.

This is not an unusual example of the time scale required to pursue maritime investigations. It is indicative of the challenging but frustrating aspects of fishery oceanography: lack of adequate funds, facilities, and equipment requires the gradual piecing together of fragmentary bits of data over long periods. Significant advances are delayed unduly when the investigators--discouraged by long intervals between major breakthroughs--abandon this field and carry away extensive background knowledge and untested theories. They leave behind them incomplete models.

Unusually Low Salinity Water

In 1935, and again in 1938, data from a few oceanographic stations indicated the presence of water of unusually low salinity south of Unimak Island (west end of the Alaska Peninsula). It was then believed that this water was carried into the area by a stream or eddy from the Gulf of Alaska. But extensive observations south of the Aleutian Islands since 1955 have enabled us to show that this low salinity water extends westward beyond the westernmost Aleutian Island--and has branches that shoot southward and eastward from this flow (thereby completing circulation in the Gulf of Alaska). Two specific examples of the flow, as indicated by the surface salinity in 1956 and 1958, and a schematic diagram for the years in which adequate data are available, are shown in figure 1. Although the westward flowing dilute water moves northward through eastern passes in the Aleutian Island chain, high salinity water (33 ‰) intrudes southward from the Bering Sea in the central part of the chain and forces the dilute water offshore. The flow assumes a jet-like character, with westward velocities in excess of 50 cm./sec. (about 1 knot) and sometimes as great as about 100 cm./sec.

In summer 1959, we were able to define this current system, which also advects warm water into the western North Pacific Ocean; we assigned it the name "Alaskan Stream." Evidence was obtained that the Stream terminated near long. 170° E., where the main flow was northward into the Bering Sea. Not until 1962 were we able to obtain winter observations and show that this flow was not limited to the spring and summer--but was a year-round feature. In 1966, we were able to show that the westward flow also ended near long. 170° E. in winter.

Sharp Surface Fronts Detected

During the spring of 1969, while using continuously recording surface temperature and salinity devices at long. 175° W., we encountered sharp surface fronts at the northern and southern boundaries of this flow. In some instances, the change in water color was very noticeable, although no unusual activities of sea birds or seals were reported. One would expect the change in ocean conditions to be more striking farther westward, however, between long. 170° E. and 180° near lat. 50° N.; there, the Alaskan Stream meets with the northward branch of the Subarctic Current at the eastern boundary of the Western Subarctic Gyre (fig. 2).

An Asian source of dilute coastal water, shown to intrude seaward off the Kuril Islands

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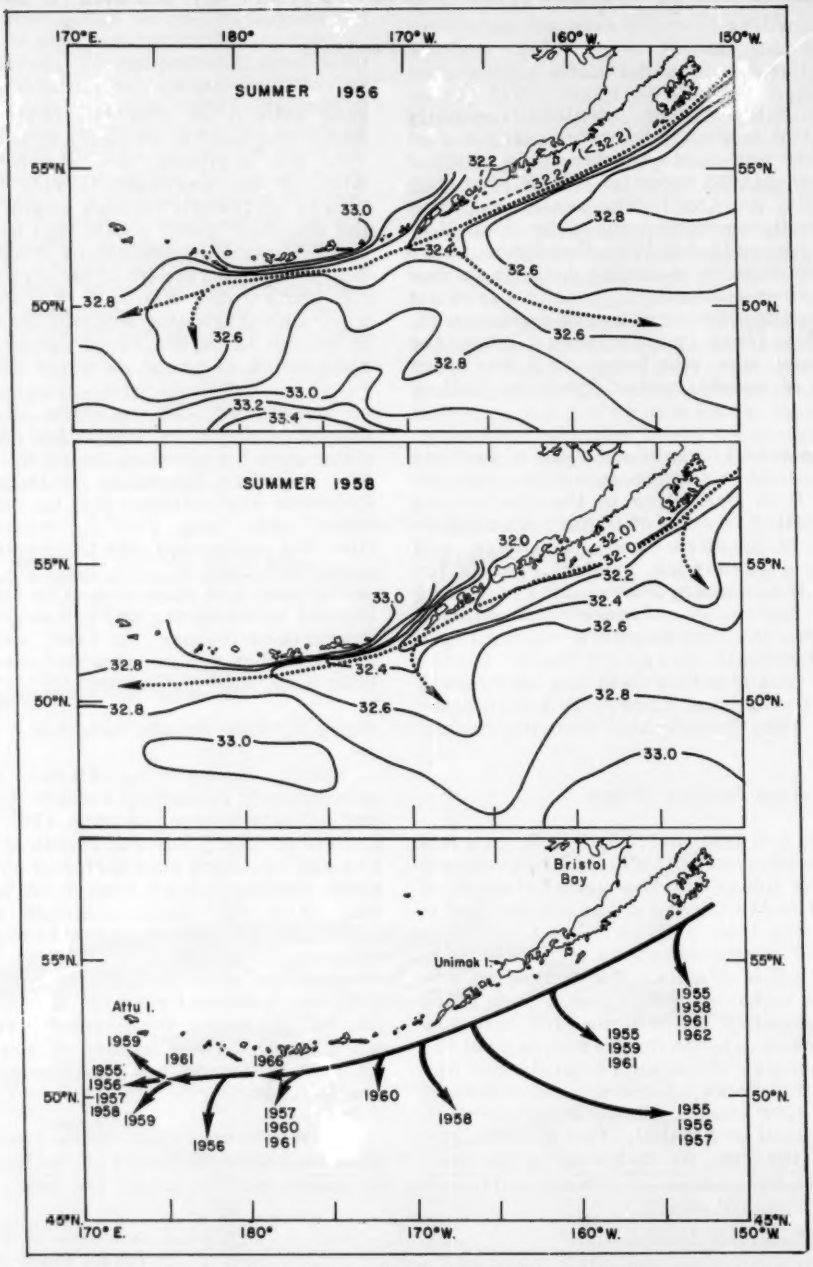


Fig. 1 - Surface flow along the south side of the Aleutian Islands (as indicated by surface salinity, in parts per thousand) showing continuity of the westward flow in summer 1956 and 1958; lower panel, variability in location at which southern branches diverge from main flow.

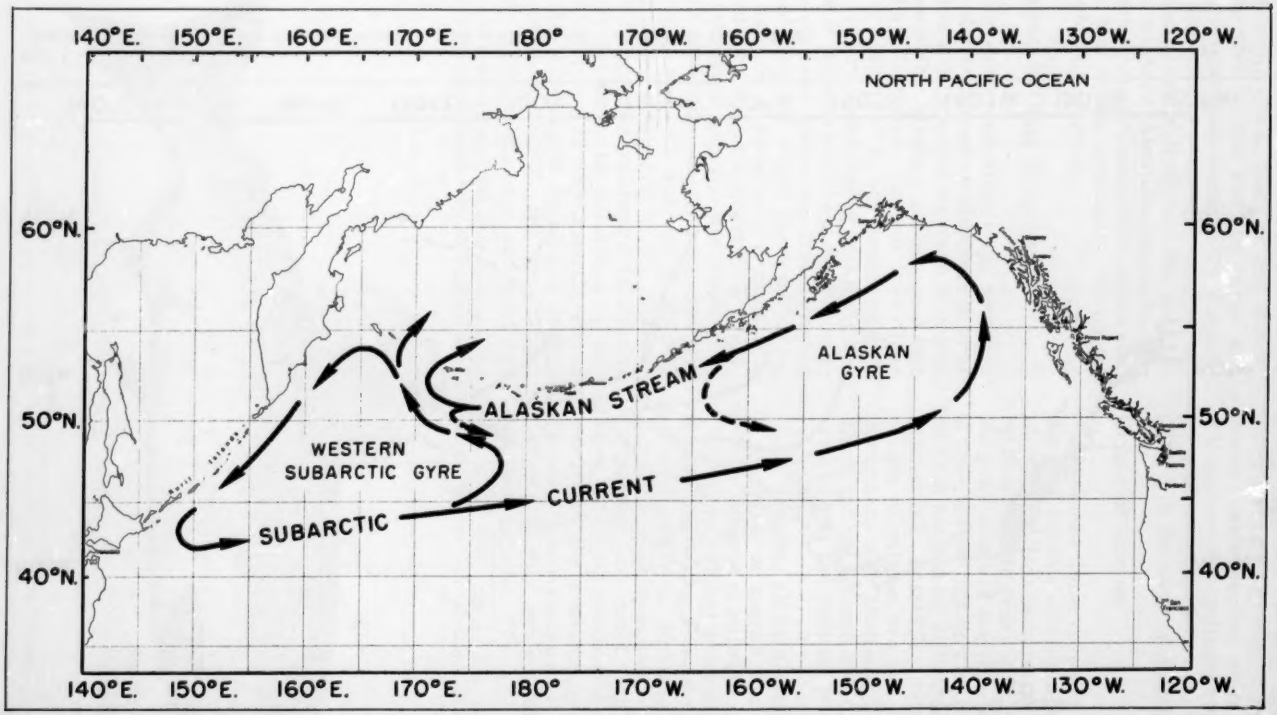


Fig. 2 - Schematic diagram of circulation in Subarctic Pacific Region south of the Aleutian Islands, showing Alaskan and Western Subarctic Gyres--and location (long. 170° E.) where westward-flowing Alaskan Stream meets northern branch of Subarctic Current.

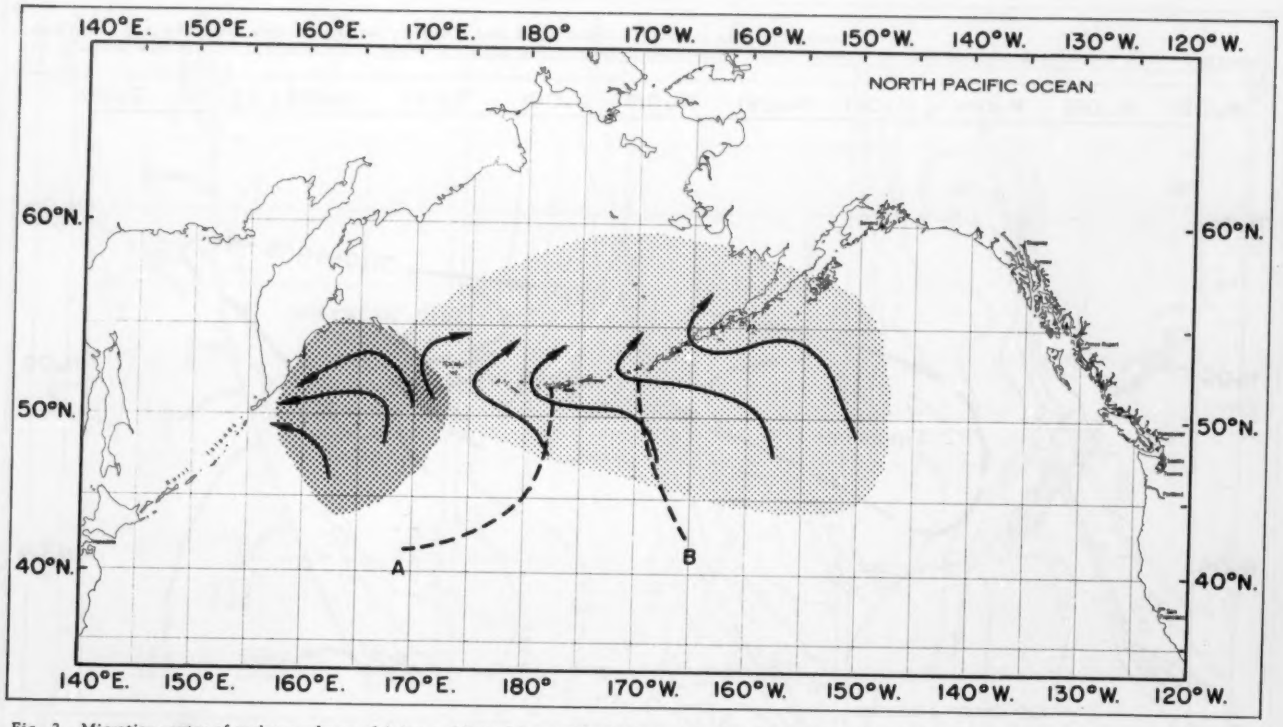


Fig. 3 - Migration routes of sockeye salmon of Asian and Bristol Bay origin during spring, the eastern limit (A) of distribution of sockeye salmon of Asian origin, and the western limit (B) of sockeye salmon of Gulf of Alaska origin (after Kondo et al., 1965).

('Fishery Oceanography IV', CFR, Nov. 1969), enters the ocean in southwestern part of Western Subarctic Gyre. Part of this water, whose properties in the surface layer are strikingly different from those in the Alaskan Stream, is advected cyclonically around the gyre and encounters water from the Stream south of the western Aleutian Islands. The rest continues eastward and mixes with water to the north and south, gradually losing its identifying characteristics.

Sockeye Salmon & Their Environment

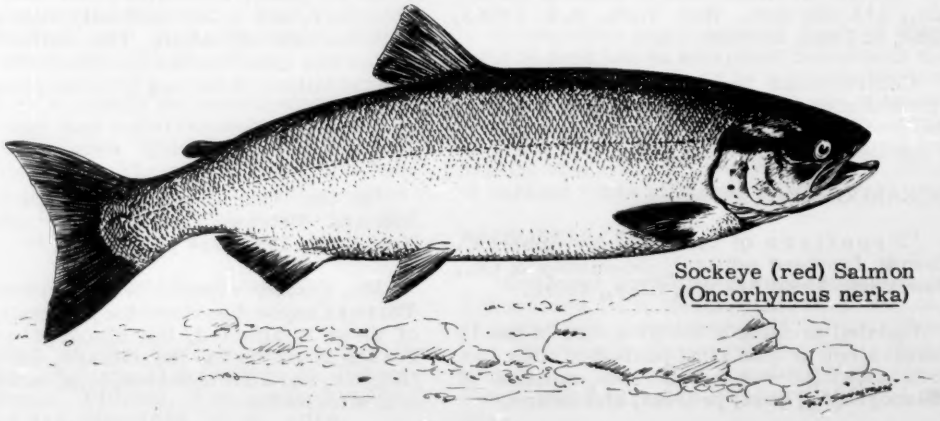
During our early investigations, changes in salmon catch occurred as the vessels proceeded southward from the western Aleutian Islands through the Alaskan Stream and into Western Subarctic water. But our investigations west of long. 175° E. have been limited. Three particularly interesting relations between sockeye salmon and their ocean environment have been indicated from tagging experiments[1/] (fig. 3): First, the distribution of sockeye salmon of Asian origin appears to be associated with the general extent of Western Subarctic Gyre and the distribution of those of Gulf of Alaska origin with Alaskan Gyre. Second, sockeye salmon of Bristol Bay origin move westward in the Alaskan Stream before turning eastward to Bristol Bay; thus they appear to be influenced by this current. Third, there is only a small area of presumed intermingling of Asian and Bristol Bay fish near long. 170° E., the area where water from Alaskan Stream and northern branch of Subarctic Current meet. The foregoing suggests not only that these stocks inhabit different environments during their ocean residence, but also that oceanic conditions have a significant effect upon salmon--as well as upon birds and mammals, as reported in the days of sailing ships.

Origin of Salmon

Japanese fishermen say that while fishing south of the western Aleutian Islands they can identify sockeye salmon of Bristol Bay origin by their subtle green coloring, in contrast to the gray-black of sockeye salmon from Asia. If true, might this be a racial characteristic, or is it caused by differences in ocean environments? Scientific determinations of the origin of salmon are based upon tagging experiments and studies of the scales, parasites, and physiological-biochemical characteristics of the various stocks.

Of course, all this evidence is offered as conjecture, or pieces of a puzzle, and not as proof. Models of migration paths are emerging--some related to oceanographic features, some not; some contested, some not completely tested. Nevertheless, even though numbers of salmon caught may show what is happening, one must turn to fishery oceanography to ascertain why. Many people believe that the availability of food organisms influences movements of salmon. Some aspects of this subject will be presented in the next article.

1/Kondo, Heihachi, Yoshimi Hirano, Nobuyuki Nakayama, and Makoto Miyake. 1965. Offshore distribution and migration of Pacific salmon (genus Oncorhynchus) based on tagging studies (1958-1961). Int. N. Pac. Fish Comm. Bull. 17, 213 pp.



Sockeye (red) Salmon
(Oncorhyncus nerka)

CATFISH FARMING

"Construction of Commercial Catfish Ponds," prepared by T. D. Prestridge Jr. and Edward R. Smith, Department of Agriculture, Soil Conservation Service, Alexandria, La., January 1969, illus.

This is a one-page leaflet outlining some important construction features required for catfish production--pond types, water areas, depth, control, and supply.

DOLPHINS

"Dolphin Noises Recorded by Echo-Sounder," by L. J. Paul, Fisheries Research Publication No. 129, Marine Department, Wellington, New Zealand. (Reprint from 'N. Z. Jl. Mar. Freshwat. Research,' Vol. 3, No. 2, June 1969, pp. 343-8, illus.)

Some records of ultrasonic signals from dolphins seem to suggest these emissions are used for echo-ranging. Mr. Paul explains the possible uses of such records in studying dolphin behavior.

MARINE MAMMALS

"The Biology of Marine Mammals," edited by Harald T. Andersen, Academic Press, Inc., 111 5th Ave., New York, N.Y. 10003, 1969, 511 pp., indexed, illus.

Contributions from experts in different areas of marine mammal research emphasize the functional biology of mammals adapted to a marine habitat.

OCEANOGRAPHY

"Frontiers of the Sea," by Robert C. Cowne (revised edition), Doubleday & Co., New York, 1969, 318 pp., illus., $6.95.

Updated to include the progress of the 10 years since it was first published, this is a book about the oceans and the science of oceanography, past, present, and future.

PACIFIC SALMON

"Round Trip With the Salmon," by Anthony Netboy, article, 'Natural History,' American Museum of Natural History, Vol. 77, No. 6, June-July 1969, pp. 44-50, 66-67, illus.

Mr. Netboy narrates the migratory drama of the millions of salmon spawned in the rivers of North America and Siberia, their life in the salt water pastures of the North Pacific, and their return to natal waters to mate and die. Charts of their ocean migration patterns are included.

PESTICIDES

"DDT in Trout and Its Possible Effect on Reproductive Potential," by C. L. Hopkins, S.R.B. Solly and A. R. Ritchie, Fisheries Research Publication No. 130, Marine Department, Wellington, New Zealand. (Reprint from 'N. Z. Jl. Mar. Freshwat. Research, Vol. 3, No. 2, June 1969, pp. 220-9.)

Eggs of rainbow trout (Salmo gairdneri Richardson) were reared to discover whether they showed significant survival differences that could be linked with DDT levels in the tissue. The eggs were taken from trout in 5 different lakes: three drain land often treated with DDT, and 2 are virtually free of agricultural contamination. The authors found a possible link between the presence of DDT and the failure of the egg to develop normally.

POLLUTION

"In the Wake of the Torrey Canyon," by Richard Petrow, David McKay Co., Inc., New York, 1968, 256 pp., illus.

Mr. Petrow reports on all aspects of the Torrey Canyon disaster--the personal stories of those it affected, the blunders and successes in repairing the damage, and the unfinished, and still unsolved, legal and biological aftermaths.

"Marine Pollution: can we control it to advantage?" by Maurice Fontaine, article, 'Ceres,' FAO Review, Vol. 2, No. 3, May-June 1969, UNIPUB, P.O. Box 433, New York, N.Y., pp. 32-5, illus. (Single issue $0.50.)

Mr. Fontaine believes a good use should be found for pollution agents after they have been controlled. He suggests several methods of study.

SALT WATER AQUARIA

"The Marine Aquarium," by Robert F. O'Connell, Great Outdoors Publishing Co., 4747 28th St., North, St. Petersburg, Fla., 33714, 158 pp., illus., $6.95.

This is a comprehensive description of how to set up an ideal marine tank, and to create the conditions in which marine fish will thrive. It includes the latest techniques and equipment for filtration, heating, lighting, decoration, and feeding. Superb color photographs of many species are included.

FISH & WILDLIFE SERVICE PUBLICATIONS

The following reports, published by the Department of the Interior, Fish & Wildlife Service, BCF, are available from Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209:

Alaskan Freshwater Fishes

"Distribution of Fishes in Fresh Water of Katmai National Monument, Alaska, and Their Zoogeographical Implication," by W.R. Heard, R. L. Wallace, and W. L. Hartman, SSR-F 590, October 1969, 20 pp., illus.

This is a report on investigations of the distribution and occurrences of freshwater fishes in an area divided by the Aleutian Mountain Range. The authors describe their methods and equipment, discuss the zoogeographical implications, and include an annotated list of species.

Gulf of Mexico Fisheries Research

Florida

"Report of the Bureau of Commercial Fisheries Biological Laboratory, St. Petersburg Beach, Florida, Fiscal Year 1968," Circular 313, May 1969, 25 pp., illus.

The report describes the laboratory's research on projects in the estuarine, red-tide, and industrial schoolfish programs. The projects include studies of sediments and organisms in bay bottoms; plankton crops; fishes in and transferring between estuaries and the Gulf of Mexico; and experimental rearing of pompano in an impounded lagoon.

Texas

"Report of the BCF Biological Laboratory, Galveston, Texas, Fiscal Year 1968," Circular 325, October 1969, 32 pp., illus.

This report describes the progress of research on shrimp involving biology, population dynamics, ecology, and oceanography. It includes a summary of methods used to evaluate engineering projects that affect estuary-dependent species on the Texas coast.

Mississippi

"Report of the BCF Technological Laboratory, Pascagoula, Mississippi, Fiscal Years 1967 and 1968," Circular 327, 18 pp., illus.

This report presents the results of research on new and improved methods of preventing development of browning in snapper; rancid odors and flavors in Spanish mackerel; adverse texture changes in frozen oysters; blue discoloration in crab meat; green discolorations in frozen raw breaded shrimp; and adverse changes in canned shrimp during storage.

It describes a countrywide study of shipment of iced fish in leakproof containers and discusses new attempts to increase the iced storage life of shrimp through use of bacteriostatic agents. The report includes developments in sanitary handling of fish meal and results of a study to mechanize the handling of various types of industrial fish.

RADIOECOLOGY

"Research Facilities of the Radiobiological Laboratory, BCF, Beaufort, North Carolina," Circular 298, December 1968, 17 pp., illus., and "Progress Report of the BCF Radiobiological Laboratory, Beaufort, N.C., Fiscal Year 1968," Circular 309, April 1969, 59 pp., illus.

Radioecology is the study of radioactivity in the environment and the use of radioactive elements in ecological studies. The Beaufort Radiobiological Laboratory is supported jointly by BCF and the U.S. Atomic Energy Commission. Its research is concerned with 1) the fate of radioactive materials in the estuarine environment, 2) the effect of radiation on marine organisms, and 3) the application of radioactive tracer techniques to fishery biology.

Circular 298 describes the history, facilities, and organization of the lab. Circular 309 describes some of its studies in estuarine ecology, biogeochemistry, pollution, and radiation effects.

SALMON

"Return and Behavior of Adults of the First Filial Generation of Transplanted Pink Salmon, and Survival of Their Progeny, Sashin Creek, Baranof Island, Alaska," by Robert J. Ellis, SSR-F 598.

In 1964, 1,866 adult pink salmon from another stream were planted in Sashin Creek. Circumstantial evidence indicated that adult pinks spawning in Sashin Creek in 1966 were mostly progeny of the fish transplanted in 1964. Mr. Ellis describes the study area, and the number, time of migration, distribution, and fecundity of the spawners.

--Barbara Lundy

WHAT IS "FISH FARMING" AND WHERE IS IT PRACTICED?

For the most part, man's role is still that of a hunter rather than a farmer of the sea. In the future, however, it is probable that food shortages will require regulation of the life cycles of marine animals and plants in much the same way as on land. This might include altering the bottom environment, hatching of fish eggs, fencing breeding areas, fertilizing plants, and use of drugs to control diseases.

Japan has developed fish farming and aquaculture to a higher degree than any other country. Fish-farming centers have been established in the Inland Sea to offset the decrease in catch of high quality fish in coastal waters. Eggs are hatched and fry released into the waters of the Inland Sea.

By growing oysters on ropes hanging from rafts, the Japanese have increased the yield per acre to 50 times that of conventional methods. Oyster culture is also highly developed in the Mediterranean Sea where oysters are harvested from sticks thrust into the shoal bottom.

Off the coast of California old streetcars and automobiles have been dumped into the ocean to form artificial reefs to attract fish.

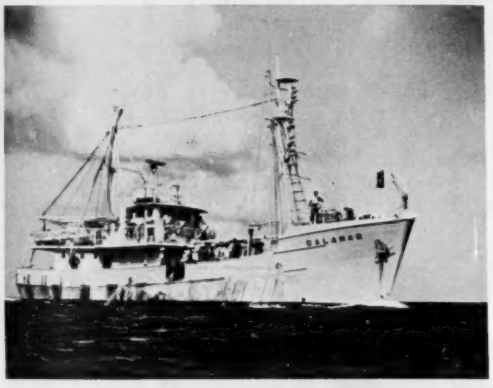
Possible methods of fencing sea areas include the use of nets, electrical impulses, and ultrasonics.

Fertilizers have been used experimentally in enclosed areas of the sea, but they have stimulated growth of weeds and unwanted species as well as of desirable fish. ("Questions About The Oceans," U.S. Naval Oceanographic Office.)

INTERNATIONAL

THE FAO FISHING FLEET

The United Nations Food and Agriculture Organization (FAO) operates one of the world's largest fishery research fleets. Its 28 vessels are found in nearly all oceans, in many seas, and in 4 large African lakes. Easily recognized by their brilliant blue stack with the UN insignia painted on both sides, each flies the flag of the country in which it is registered, although all are home-ported in Rome. They are manned by FAO experts and nationals of the countries they serve.



The vessels are used in FAO/UNDP fishing programs in 15 developing nations, and 3 regional projects that embrace 23 countries and territories. These include Argentina, Colombia, Pakistan, Ghana (Lake Volta), India, Korea, Zambia (Lake Kariba), Mexico, Nigeria, the Philippines, Senegal, Sierra Leone, Singapore, the UAR (Lake Nasser), S. Vietnam, Caribbean countries, Central America, and around Lake Victoria in Africa.

The Vessels

Each vessel has been designed by an experienced naval architect in the Boats and Equipment Section in collaboration with other branches of FAO's Fisheries Department. Most have been designed for particular projects, but all are versatile. They are used for experimental and exploratory fishing, scientific investigations, demonstrations of fishing techniques, training fishermen and mechanics, and for many other purposes.

They range from a pair of 8.23 meter catamarans in Lake Kariba to a 44.28 meter US$300,000 "Japanese-type" tuna longliner in Korea. Many cost more than similar commercial fishing vessels because of their specialized equipment and instruments. However, nearly all are fishing boats rather than sophisticated research vessels.

Latest Equipment

Twenty-three have steel hulls, 4 have reinforced plastic hulls, and one is wooden. Ship's complement--crew, scientists, and trainees--runs from 4 to 60. Their propulsion systems vary from 80 to 800 hp; the engines are manufactured in factories around the world. Many are equipped with the latest electronic, navigational, and fish-finding devices--radar, sonar, echo sounder, directional compasses, loran, radiotelephone, automatic pilots, and various winches and catch-handling gear. Some also have well-equipped scientific laboratories. Equipment is selected according to specific needs.

Over $5-Million Fleet

The cost of building, equipping, and delivering this fleet now exceeds US$5 million. The money is contributed by the UN Special Fund and participating governments. Nine were built in England, 8 in Japan, 5 in Holland, 4 in Norway, and 2 in Mexico. The first was built in Japan in August 1965. The two newest, also built in Japan, were to be delivered to the Korean Training Center for coastal fishing in 1969. The shipyards deliver them anywhere. They navigate under their own power, ride as cargo on other vessels, and are even sent by truck (for example, a boat destined for Lake Victoria).

Boats Leased Too

FAO also uses all types of leases and secondhand boats. During the past 3 years, about 8 have been used. One, a leased boat, is investigating pelagic fishing under a regional fishery project that will benefit nearly all West African nations.

The architects are kept busy designing new vessels as new assistance plans are drawn. Twelve are being planned or considered.

FAO SCHEDULES SECOND WORLD FOOD CONGRESS FOR JUNE 1970

FAO has scheduled the Second World Food Congress for June 16-30, 1970, in the Netherlands. The first phase will assess the world food situation, within framework of overall economic development; it will propose priorities for action. The second phase will discuss how to find the resources necessary for the action.

8 Commissions

The debate will be conducted in 8 commissions. The 4 commissions of Phase I are based on the vital factors in national development. The first commission will focus on ensuring food supplies; the second on higher living standards and improved diets; the third on people in rural development. FAO notes that populations are rising faster than job possibilities--even with the drift to urban areas. The number of people who make their living in rural areas is rising steadily.

Developing Trade

The fourth commission will consider ways of strengthening trading position of developing countries and increasing their export earnings. Their vital export trade is almost entirely agricultural products.

Phase II

Phase II will face the implications of proposals made in Phase I and concentrate on finding ways and means of carrying them out.

FISH-MEAL MANUFACTURERS EXAMINE WORLD TRENDS

Fish meal is in short supply. This was the major finding in an examination of world production, sales, and consumption at the 9th Annual Conference of the International Association of Fish Meal Manufacturers (IAFMM).

As a result, prices have risen to high levels. Some members are concerned that fish-meal sales will suffer and inventories accumulate.

Reasons for Production Decline

The production decline is attributed to the failure of the fish to appear in their usual areas off Peru and, to a lesser extent, in Scandinavia. (Regional Fisheries Attaché, U.S. Embassy, Copenhagen, Oct. 17, 1969.)

FROZEN GROUNDFISH SUPPLIERS MEET

Government officials from Canada, Denmark, Iceland, and Norway held the third meeting in a series of major world suppliers of frozen groundfish in Ottawa, Oct. 15. The series began in Copenhagen last March.

Reviewing the current world situation, they noted the market had been able to retain the basic strength and stability evident through most of 1969. They agreed that production and trade in general have improved, while end-product consumption has increased rapidly in the principal world markets.

Forecast 1970 Stocks

Examining the medium-term outlook, they concluded that current stock levels are normal. But with peak production period past, and consumption rapidly increasing in major importing markets, world stocks may be very low by first-quarter 1970. This should further strengthen the market.

The participants agreed to keep world production and market trends under review and to consult periodically. (Dept. of Fisheries and Forestry, Canada, Oct. 16, 1969.)

JAPAN-MEXICO FISHERY CONFERENCE ENDS

Delegates from Japan and Mexico met in Mexico City, Sept. 29-30, 1969, to discuss their fishery agreement. In effect since June 10, 1968, the agreement covers Japanese fishing inside Mexico's 12-mile exclusive fishery zone.

After reviewing operation of the agreement, Mexico did not propose further restriction of Japanese tuna fishing. Japan had anticipated this move in view of the Mexican President's recent statement urging that territorial waters be extended from 9 to 12 miles. ('Suisan Tsushin,' Oct. 4, 1969.)

5 NATIONS SIGN CONVENTION ON SOUTHEAST ATLANTIC

The Convention on the Conservation of the Living Resources of the Southeast Atlantic was formally signed by Cuba, West Germany, Italy, Portugal, and South Africa at a meeting in Rome, Oct. 23, 1969. Belgium, France, Japan, Republic of Korea (South Korea), Spain, and Togo endorsed, but did not sign, the document. Observers from Brazil, Republic of China (Taiwan), Ecuador, Poland, and the U.S. were present.

The agreement becomes effective when ratified, or is otherwise adhered to, by at least 4 states with a combined 1968 catch in the area of 700,000 metric tons. It is open for signature by all interested countries.

Terms of Convention

The convention's 21 articles establish an international commission for the southeast Atlantic fisheries. The commission, aided by a scientific advisory council and regional and stock committees, will study and recommend ways to conserve fish and other living resources in the area.

The convention area runs west and south of the mouth of the Congo River to the Cape of Good Hope and the Indian Ocean. It covers roughly 8 million square miles between 6 and 50 degrees south latitude, and between 20 degrees west and 40 degrees east longitude.

Area Heavily Fished

Fishing in this area has increased 30 times in as many years. It has risen from less than 100,000 metric tons a year before World War II to 2,600,000 tons in 1967, and to 3,300,000 tons in 1968. The 1968 catch value was about US$200,000,000. This increase has seriously strained certain stocks, mainly hake and pilchard. International action is necessary to avoid depletion. The area's tuna and whales already are covered by international agreements.

Predominant fishing countries in the southeast Atlantic are South Africa, USSR, Portugal (Angola), Spain, and Japan. In 1968, South Africa took 2,000,000 tons and the USSR almost 500,000. Other countries are Belgium, Bulgaria, West Germany, France, Taiwan, Israel, South Korea, and Poland.

Need for Conservation Stressed

A Portuguese resolution calling for an expert study of the state of stocks in the southeast Atlantic before the International Commission meets was approved. The resolution warned that certain stocks appear to be heavily exploited, and that conservation measures are needed urgently.

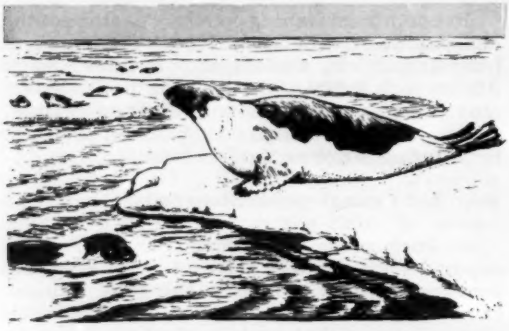
Another approved resolution recommended establishment of 'adequate medical, technical and meteorological services' for protection of fishermen in the area.

After the signing, the South African representative called for speedy action to bring convention into force. He warned of danger of depleting fishery stocks in southeast Atlantic. He added: "We cannot deny that pressures have been building up in our country to seek measures to protect our long-term interests more adequately." (FAO, Rome, Oct. 23, 1969.)

CANADA

HUNTING BABY SEALS BANNED IN 1970

Canada will ban the hunting of 'whitecoats' (baby harp seals) in the Northwest Atlantic in 1970. It is hoped the Norwegians will adopt a similar ruling. This would make ban effective in the Gulf of St. Lawrence and on the Labrador Front. Norway has been the only other country actively fishing harp seals in the Northwest Atlantic in recent years.



Under the ban, only 'beaters' (animals up to 80 pounds, and well beyond the 'whitecoat stage') may be taken. No longer accompanied by their mothers, they swim or 'beat' north to Arctic waters.

New Regulations

The hunt will have a later opening date. The use of aircraft, including helicopters, will be prohibited. Commercial operations will be confined almost entirely to ships. However, individual landsmen, walking out from shore, also will be allowed to take 'beaters' during open season. Because 'beaters' are far more mobile than baby seals, they will be hunted with rifles instead of clubs.

Advantages of Ban

The new regulation does away with the most offensive characteristics of the sea hunt. It also protects Canadians dependent on the seal fishery for a living. The sealing vessels employ mainly Newfoundland fishermen. The landsmen from Quebec and the Maritime Provinces also will gain because 'beater' skins now are more valuable than the smaller 'whitecoats.' (Canadian Dept. of Fisheries and Forestry, Oct. 15, 1969.)

* * *

MARITIME PROVINCES LAND BILLION POUNDS IN FIRST 9 MONTHS

One billion pounds, worth C$58.1 million were landed in the Maritime Provinces (N.S., P.E.I., N.B.) in first 9 months 1969. In same period 1968, landings were 1.1 billion pounds, worth C$57.4 million; in 1967, 855 million pounds, worth C$47.9 million.

September Landings

September landings were 163.4 million pounds worth C$7.2 million--51.9 million pounds of groundfish (C$2.4 million), 106.2 million pounds of pelagic and estuarial species (C$1.9 million), and 5.3 million pounds of shellfish (C$2.9 million). (Canadian Dept. of Fisheries & Forestry, Nova Scotia, Oct. 23, 1969.)

EUROPE

USSR

PURSE SEINING FOR COD & WALLEYE POLLOCK DEVELOPS IN FAR EAST

TINRO is introducing purse seining for cod and walleye pollock to the Soviet Far Eastern fishing fleet. The fleet operates in the Gulf of Anadyr (northern Bering Sea) and off West Kamchatka.

TINRO is the Soviet Pacific Fisheries and Oceanography Research Institute. It also plans to introduce purse seining for mackerel, tuna, sardines, and horse mackerel. So far, the Soviets have been seining only for herring in the Pacific. Purse seining for cod differs from herring in exploratory techniques and transshipment of catch to factoryships.

Purse-Seining Cod

Cod is a groundfish. Its schools are better detected by hydroacoustic devices than by conventional fish finders. Casting the purse seine following echo-sounder readings requires considerable experience. Soviet Far Eastern fishermen are now being trained in the new technique. Catches must be transshipped simultaneously to 2 or 3 vessels because cod are filleted as seines are emptied, and this takes time.

Large concentrations of cod and walleye pollock were discovered in the Gulf of Anadyr at 70-80 meters.

TINRO To Scout Fish

To prevent the commercial fleet from wasting time looking for fish, TINRO will assign one exploratory vessel to scout northwestern Bering Sea (off Soviet Coasts) from May 15. Another exploratory vessel will join in June. Due to weather, the fishing season in Gulf of Anadyr is from June to October. ('Rybnoe Khoziaistvo,' No. 9, 1969.)

* * *

HOPES TO IMPROVE AT-SEA CATCH TRANSFERS

The Fisheries Ministry has announced a contest for the best method of "contactless" at-sea catch transfer. The Ministry hopes to discover an efficient at-sea transfer technique eliminating side-by-side anchoring. Present practice frequently damages vessels and causes delays while vessels await favorable weather and sea conditions. A "contactless" method would permit one-way transfers of 20 metric tons an hour in rough seas (winds up to 46 miles an hour).

Big Prizes

The contest, cosponsored by Scientific and Technical Society of the Food Industry, and Food Industry Workers' Trade Union, will award 7,750 rubles (US$8,525) in prize money. First prize is 2,000 rubles ($2,200). The contest closes June 1, 1970. It is limited to Soviet citizens. ('Rybnoe Khoziaistvo,' No. 8, 1969.)

* * *

TANKERS USED TO TRANSPORT FISH MEAL

Tankers supplying the Atlantic fishing fleet with fuel and water carry fish meal in the emptied holds on their return trips.

With recently improved transfer techniques, all 4 stern hoists of a stern factory trawler (BMRT) are used to lift nets with 50-60 110-pound fish-meal bags and lower them into the tanker's storage space. Using this method, 120 metric tons can be transferred in 8 hours. ('Rybnoe Khoziaistvo,' No. 8, 1969.)

* * *

OIL-SPILL "CLEANING" VESSEL IS BUILT

The Soviets have announced construction of an oil-spill "cleaning" vessel capable of collecting from the sea surface up to 7 metric tons of oil in one hour. Aptly named 'Sanitar,' she is the prototype of a class. (TASS, Moscow, July 29, 1969.) No additional details are available.

U.S. Model Tested

The U.S. Technocean Company announced that it has tested a small-scale model of a craft designed for the same purpose. The

USSR (Contd.):

17,000-ton vessel will be a 'hybrid': its forward section will have a conventional single hull; aft, it will be a catamaran. It will move backwards, suck up the water with the floating layer of hydrocarbons at a rate of 62,905 (or 10,000 tons) an hour, separate the oil, and pump the clean water back into the ocean.

Ocean Research Too

According to the designers, the space between the twin hulls of the catamaran portion can be used for high-seas oceanographic research and for operations with small submersibles or bathyscaphes. ('Ocean Industry,' Oct. 1969.)

* * *

SPORT FISHING DEPLETES COMMERCIAL STOCKS

Caspian Fisheries Research Institute (KASPNIRKh) scientists blame the stock depletion of Caspian roach, Rutilus rutilus caspicus, on sport fishing.

Caspian roach (vobla), a silver-white European cyprinid fish, is one of the most valuable commercial species of the Volga-Caspian region. KASPNIRKh's efforts to protect the stocks, by reducing net-mesh size in autumn and increasing it in spring, have been defeated by anglers who take small fish (3-year-olds, spawning for the first time) in the spring, and large fish (4-year-olds entering commercial resource for first time) in the autumn. The spawning stock reproduction decreases and abundance of future year-classes cannot be assessed.

Many Angler Groups

In January 1966, 2.3 million Soviet sport fishermen were listed in societies and organizations. There are many more who are non-members. In the USSR, sport fishing is free to all citizens. There, unorganized fishermen nullify the measures taken to protect and increase the stock.

Expanding sport fisheries are likely to become a major problem for Soviet commercial fisheries in addition to the Caspian or Bolga Delta. ('Rybnoe Khoziaistvo,' No. 8, 1969.)

* * *

STERN FACTORY TRAWLER EQUIPPED WITH UNDERWATER ELECTRIC LIGHTS

For the first time, a large stern factory trawler of the Northern Fisheries Administration (SEVRYBA) has been equipped with underwater searchlights, fish traps, and special catch-lifting gear. She will fish off West Africa. Heretofore, only medium trawlers have practiced underwater electric-light fishing. (TASS, Moscow, Oct. 10, 1969.)

* * *

FISHERIES MINISTER DENIES SOVIETS FISH SALMON OFF BRITISH COLUMBIA

After 2 Soviet trawlers had been arrested inside the 12-mile limit off Vancouver Island, rumors persisted among Canadian fishermen that the Soviets had been fishing salmon. Fisheries Minister Jack Davis and Fisheries Department officials flew over the Soviet fleet on August 11, 1969.

Soviet Trawlers Photographed

Fish aboard Soviet trawlers were photographed. Fishery biologists from Nanaimo Laboratory studied enlargements and determined that the catches were "silver-sided rockfish". Those glisten with a silvery sparkle like salmon, but are easily distinguishable from salmon by their round, flat shape.

Not Taking Salmon

The Minister said "there is no indication that the Soviet fleets are taking Pacific salmon." However, some claim that the Soviets may be taking salmon as incidental catch because this also happens to Canadian fishermen. ('Western Fisheries,' Aug. 1969.)

* * *

SOVIETS CONCERNED ABOUT CARELESS FISHING-VESSEL OFFICERS

An official of the Soviet Sakhalin Fisheries Administration has complained about the careless and scornful attitude of officers and engineers aboard fishing vessels that results frequently in vessel damage.

In September 1968, the factoryship 'Sovetskii Sakhalin' ran aground in Terpenie Bay

USSR (Contd.):

(southeast Sakhalin) off Cape Obshirnyi. Visibility was excellent, and the vessel was equipped with the latest electronic navigational instruments. An inquiry revealed that the first mate had changed the vessel's position twice without informing the captain; no watch officer had bothered to check the vessel's coordinates, and the third mate determined her position "by ear" and entered it in the log. The inquiry board ruled this accident "the result of criminal negligence on the part of the navigation officers, and a deplorable performance of the officers' duties."

Tanker Hits Bottom

The tanker 'Ursul,' en route from Korsakov to Nevel'sk (southern Sakhalin), hit bottom in Aniva Bay off Cape Anastasia. When the accident occurred, the second mate was drunk and had left the bridge without authorization. When the vessel was crossing the dangerous area, the captain himself was not on the bridge.

Fishermen, Not Seamen

The fishery official complained that crew members, old and young, frequently feel they are fishermen, not seamen. So they see no need to keep up navigational rules and traditions dear to seamen. Responsibility for this attitude is the navigation schools', which teach and train officers and specialists for the fishing fleet.

The official added that conspicuously absent at the Sakhalin School of Navigation, for instance, is a course in marine ethics stressing old traditions, discipline, and behavior. Instead, students readily adopt bad habits--"smartness and drinking while getting one's feet wet."

Of greatest importance is the example set by the captain, first mate, or chief engineer. Skippers "appearing on the bridge in a cloud of alcohol fumes" are bound to depress and demoralize the crew. ('Vodnyi Transport,' Oct. 18, 1969.

* * *

TOP-LEVEL FISHERY ECONOMISTS CONFER

Soviet fishery executives met in Sept. 1969 to discuss: fisheries expansion; catch efficiency; new planning methods; results of the economic reform; economic stimulation in fisheries production; and improving bookkeeping, accounting, and economic analysis in the fishing industry. ('Rybnoe Khoziaistvo,' No. 7, 1969.)

Economic Reform Implemented

The Fisheries Ministry is one of 22 that have implemented economic reform throughout; 23 are still lagging. ('Ekonomicheskaia Gazeta,' No. 35, Aug. 1969.)

* * *

FISHERY SUMMIT MEETING HELD IN LENINGRAD

Members of the Joint Commission on the Development of High-Seas Fisheries (Bulgaria, East Germany, Poland, Rumania, and the USSR) held a 10-day meeting in Leningrad September 1969.

They discussed coordination of fishery research, rational utilization of fishery stocks, fishing vessel construction, gear, equipment and automation. They also reviewed fisheries cooperation during the past 2 years. (TASS, Sept. 18, 1969.)

* * *

EXPORTED $6.3 MILLION OF MARINE PRODUCTS TO JAPAN IN 1968

Japan imported over 28,000 metric tons of fishery products worth about US$6.3 million from the Soviet Union in 1968. Both quantity and value were down from 1967, a

Soviet Exports to Japan, 1967-1968

Commodity	1968 Quantity Metric Tons	1968 Value US$ 1,000	1967 Quantity Metric Tons	1967 Value US$ 1,000
Fresh or frozen:				
Herring	4,277	717	3,365	534
Shrimp, northern	1,418	303	9,835	3,213
Other	9,666	2,267	15,619	2,058
Total	15,361	3,287	28,819	5,805
Dried, salted, or smoked:				
Cod roe	563	322	277	151
Herring roe	200	415	97	178
Other	2	1	819	134
Total	765	738	1,193	463
Canned	187	233	252	551
Oils and fats	574	58	432	65
Fish meal	11,488	2,013	6,320	1,002
GRAND TOTAL	28,375	6,329	37,016	7,886

USSR (Contd.):

peak year for Soviet fishery exports to Japan. The largest decreases were in "northern shrimp" and "other fresh and frozen products."

Northern Shrimp

The Soviets catch small North Pacific shrimp off Alaska, around the Shumagins on Portlock Banks, and in Anadyr Bay. The decrease in northern shrimp imports was reportedly caused by Japanese unwillingness to pay the prices demanded by DALINTORG, the Soviet Far Eastern fisheries trade firm.

Each year about 40,000-45,000 metric tons of fresh Alaska pollock are transshipped to Japanese fish-meal processing vessels in the Sea of Okhotsk. ('Suisan Tsushin.')

* * *

PNEUMATIC FISH-MEAL CONVEYORS BEING DEVELOPED

Pneumatic conveyors to transport fish meal and bulk storage of fish meal have been given top priority for successful fishing industry development in the USSR.

In 1966, the Azov-Black Sea Fisheries and Oceanography Research Institute (AZCHERNIRO) conducted granulometry, volumetry, viscosity, and suspension-velocity studies with 8 different samples of fish meal. The meal had been produced by large stern trawlers ('Maiakovskii' and 'Tropik' classes) of the Sevastopol High Seas Fisheries Administration. The tests were made to determine the most desirable characteristics for pneumatic conveyors and the best facilities for bulk storage. ('Rybnoe Khoziaistvo,' No. 9, 1969.)

* * *

FORBIDS CONTINENTAL SHELF RESEARCH OFF NORTHERN COAST

The Soviets have refused to allow a British research trawler, 'Ernest Holt,' to carry out seabed investigations off their northern coast. The vessel was to have drilled for specimens up to 25 miles offshore. The Soviets said one of their own research vessels was doing identical work in the area. The results would be given to Britain, if requested.

Contravenes Geneva Convention

Permission was refused despite British citation of an article in the 1958 Geneva Convention on the Continental Shelf stating that "qualified institutions" must not be denied permission to do scientific research on the Continental Shelf.

The Vessel

The 177-ft. Ernest Holt was built in 1949. Based at Grimsby, she has carried out much of Britain's Arctic fishery research. ('Fishing News,' Nov. 7, 1969.)

* * *

PROPOSES ELECTRICAL FISHING FOR SALMON IN FRESH WATER

PINRO (Polar Institute of Fisheries and Oceanography at Murmansk) scientists have proposed catching salmon in fresh water with an electrical fishing device.

Some scientists believe salmon become confused by the electric current, "lose their bearing," and then can be guided easily into nets by an electric field.

PINRO scientists have experimented for several years. They found the technique successful. The fish were landed undamaged. (TASS, Sept. 24, 1969.)

* * *

FISH MEAL EXPORTS DROPPED IN 1968

The USSR exported only 28,000 metric tons of fish meal in 1968--21.6% (7,700 tons) less than the 35,700 tons in 1967.

Increasing domestic demand and lower prices abroad may have reduced 1968 exports. In 1967, an average ton of fish meal brought 131.4 rubles (about US$145); in 1968, only 121.4 (US$135). As a result of lower prices and smaller quantity, 27.6% less in foreign currency was obtained in 1968 than in 1967.

Exports to W. Germany Drop

The large decrease in 1968 exports of fish was due entirely to declining exports of fish meal to West Germany. These dropped from 15,500 tons in 1967 to 5,900 in 1968.

USSR (Contd.):

The loss was offset somewhat by additional exports to other countries.

Whale Oil Exports

Whale oil exports remained relatively stable; quantity rose but value dropped. ('Vneshniaia Torgovlia,' SSSR, No. 8, 1969.)

Exports of Fish Meal & Whale Oil, 1967-1968

Item	Quantity		Value	
	1967	1968	1967	1968
	1,000 Metric Tons		1,000 Rubles--Officially one ruble equals US$1.11	
Whale oil	57.6	59.0	6,969	6,841
Fish meal	35.7	28.0	4,693	3,400

UNITED KINGDOM

FISHING INDUSTRY EXPERTS FORECAST TO 1975

The Fishery Economics Research Unit of the British White Fish Authority has forecast the size, structure, and profitability of the British industry in the mid-1970s. It did this at the FAO Conference on Investment in Fisheries in Rome, Sept. 18-24, 1969.

The forecast indicates that the distant-water trawler fleet will total 55 to 60 vessels. The near- and middle-water fleets will be only slightly smaller than now. The inshore fleet may increase about 15%.

White Fish Decline

By applying expected catch rates to assumed capacity of the fleet's different sections, total landings of white fish may decline 15% to 20% below present level.

Consumption of fish also may decline, but at a slower rate of 0.6% to 1.3% a year. Prices may rise. Imports would tend to increase at a rate of 2.9% to 3.4% a year. ('Fishing News,' London, Oct. 17, 1969.)

* * *

LAB WILL STUDY EFFECTS OF THERMAL POLLUTION

Britain's Central Electricity Generating Board has built a marine biological laboratory beside the 2,000-milliwatt power station at Fawley. The laboratory will study effects on marine environment of heated water from power stations.

Biochemical Tests

Starting at the bottom of the food chain, effects on productivity of phytoplankton will be estimated under various conditions, according to the amount of carbon-14 assimilated. Various organisms, including the American clam, will be analyzed biochemically for relative contents of amino acids, peptides, enzymes, etc. Eventually, it may be possible to define effects of heating on specific enzyme systems. This work is to be carried out in conjunction with measurements of heat flux of the intertidal environment. The researchers intend to examine animals from particularly warm localities.

Chemical Tests

Chemists will use an autoanalyzer to look for long-term changes in sea water caused by organic nutrients. About 1,500 sq. ft. of laboratory space will be devoted to biochemistry, chemistry, ecology, physiology, and plankton. A 2,000-sq.-ft. aquarium building will receive warm sea water from the power station's outfall and cold sea water from the intake.

No Quick Results Expected

Rapid results are not foreseen because much needs to be learned about natural fluctuations in marine communities before the effects of power stations can be gauged accurately. It is hoped findings will show heated water discharged by power stations is not harmful to the sea environment. ('Nature,' Oct. 11, 1969.)

* * *

AIDS FISHERIES IN DEVELOPING COUNTRIES

United Kingdom aid to fisheries in developing countries is about US$240,000 a year. It is given directly through projects initiated and carried out by the Ministry of Overseas Development. This aid will continue at present level.

UNITED KINGDOM (Contd.):

Favors Multilateral Aid

In the future, however, if the country's balance of payments position improves, the government intends to make any additional aid multilateral. It may be interested in proposals to establish a World Fisheries Bank. ('Fishing News,' London, Oct. 17, 1969.)

NORWAY

'FRIONOR' MAKES IMPACT ON WORLD FISH MARKET

Twenty-three years ago, 136 frozen fish fillet producers recognized that even the largest Norwegian factory was small internationally. They established Frionor. Two of the country's largest firms--a private bank and an insurance company--joined them to launch Frionor with a modest share capital of 2.5 million kroner (about US$360,000).

World-Wide Sales

Frionor now exports to 30 countries. It manages its own production and sales branches in the U.S., Australia, Kenya, and Great Britain. It manages a fish shop in Prague. Frionor scored its greatest successes on the U.S. and Australian markets. Sales increases to EFTA countries also have been remarkable--despite the 10% extra tariff Britain imposed last autumn on all frozen fish from Scandinavia.

Export Explosion

In 1968, Frionor's turnover was 240 million kroner (about US$34.3 million). During first 8 months of 1969, despite unrest and uncertainty on world credit markets, exports increased up to 48.5%. A turnover increase equalling the export growth is expected for 1970.

Plant Capacity & Productivity

The export growth was backed by a 39% production increase that involved neither new investments nor new plants. The extremely flexible production system would permit a 50% increase without increasing plant capacity. Frionor's system, horizontal and vertical for fishermen, manufacturers, and marketing groups, is completely integrated; the 3 groups are not isolated.

Total Catch Utilization

Frionor has been able to exploit catches almost totally because of its success on more new markets. Cod, coalfish, rosefish, and mackerel completely dominated production a few years ago; today, Frionor sells many once-unused species, including lumpfish, blue halibut, porbeagle shark, and all kinds of shellfish. (Export Council of Norway, Oct. 1969.)

* * *

DRIED COALFISH USED FOR DOG FOOD

Dog food from dried coalfish--saithe or pollock--is fast becoming a large export item. A Norwegian firm in Aalesund has produced this type of dog food for several years. In 1968, its sales reached US$285,000.

The largest dog food market is in Sweden, but Germany and Denmark also are buying more. ('Fiskeribladet,' Sept. 19, 1969.)

DENMARK

FAROESE REBUILDING FISHING FLEET

The Faroese fishing fleet is changing. The change began in 1960 when large investments were made in so-called longline vessels of 250 to 400 tons. At that time, the entire fleet--55 longline vessels and 10 trawlers--was based on the cod fishery. The catch was salted for exports to southern Europe, South America, and Africa.

Switch to Herring

In 1965, several longline vessels were equipped with power blocks and large purse-seine nets patterned after Norwegian and Icelandic types. These vessels entered the herring fishery ranging from North Sea to Jan Mayen, north of Iceland. The Faroese herring catch increased from 20,000 metric tons in 1964 to 62,000 tons in 1968. This gave rise to a new industry, fish meal--although

DENMARK (Contd.):

half the herring were used for human consumption. Fish-meal factories have become even more important since the Faroese began fishing sand eel (launce), an important raw material in Danish fish meal.

Frozen-Fillet Production

The factoryship 'Stella Kristina' (2,000-3,000 tons) was delivered by a Norwegian shipyard a few months ago. She has a daily freezing capacity of 36 tons and, perhaps, an annual output of 2,000 tons of frozen fillets. Her entire production to 1970 already has been sold to U.S. buyers. Three sisterships have been ordered from a Norwegian shipyard for US$7 million. The State will contribute 15%; Norway gives a 7-year credit for 75%; the owners will pay 10%.

Further Fleet Expansion

The Faroese plan to add a new trawler every 12 months until 1975, and one every six months from 1975 to 1980. Their catch is expected to yield 30,000 metric tons frozen fillets in 1975 and 120,000 tons in 1980. ('Dansk Kiskeritidende,' Oct. 23, 1969.)

ICELAND

CATCH, EXCEPT HERRING, RISES

Except for herring, Iceland's catch through July 1969 was considerably better than in 1968. It has been a record capelin year--171,000 metric tons from January to April, more than double the 1968 catch, and exceeding the 1966 record of 125,000 tons. In the absence of substantial herring landings, the capelin has been used as a low-quality substitute in reduction plants.

Poor Herring Catches

The poor herring catch was the only bad news: only 15,000 tons through August. It had been 50,000 tons in same period of 1968, the worst year in recent times. A mitigating fact is that salted herring tonnage reportedly was about the same as 1968's, and price was generally higher.

Increased Export Value

The shift in emphasis from relatively low-value herring oil and meal to white fish also contributed to an increase in value of fish exports from January through July. This was US$46.4 million, compared to $40 million in same period of 1968.

The increase in export value is attributable to white or ground fish. An extremely good catch and better white fish prices and U.S. markets benefited export earnings. This improvement was reflected by changes in the frozen fillet trade. More fillets were being prepackaged in Iceland; fewer were exported in blocks or slabs for processing in the U.S.

White Fish Catch Increases

Preliminary January-August data indicate white fish catch in 1969 will be 16% higher than in 1968; by September, it may have equalled the 1966 and 1967 catches. The improvement over 1968, one of Iceland's best white fish years, apparently prevailed in both spring (January-April) and summer (May-August) seasons. The increases were 13% and 21%. (U.S. Embassy, Reykjavik, Oct. 1, 1969.)

FRANCE

MAY SUPPORT FRENCH-AFRICAN TUNA INDUSTRY

France may support the tuna industry of French-African countries, according to "La Vie Economique," Aug. 22, 1969.

France, Senegal, the Ivory Coast, Republic of Congo (Brazzaville), and the Malagasy Republic are members of a group that meets twice a year to make decisions on the French tuna market. These countries set prices to be paid to vessels for raw tuna, market prices for canned tuna, and quotas for canners and for individual countries.

There is a French tariff of 24.6% on canned tuna imports according to the General Agreement on Tariffs and Trade (GATT). Despite this, tuna is imported into France under quotas established for several countries, including Morocco.

FRANCE (Contd.):

Situation More Critical

Representatives of the 5 countries met in Oct. 1968. They were told that the French market could absorb only 40,000 metric tons of tuna--and that expected 1969 production would be around 46,000 tons. Sale of excess production is complicated because French vessels and fishermen are guaranteed higher prices than those received by other countries. The situation is becoming more critical as the tuna fleets of France, Senegal (and, in 1970, the Ivory Coast) continue to add new and more effective vessels.

What Article Says

The articles says in part:

"As far as canned tuna is concerned, the duty applicable to imports from third countries is 24.6 percent. The system of quotas is also very strict, and only Yugoslavia is allowed a quota which amounts to 900 tons. It is true that canned fish prepared in Senegal and other African countries tied to France by cooperation agreements is imported free of duty, but it should be noted that this canned fish is prepared almost exclusively from the catch of the French fishing fleet and processed in Africa by canneries in Senegal in which French canners own very important shares. Furthermore, these African countries, although allowed customs-free entry for fish, as well as for their other products, have agreed to continue to respect the limitation of their exports to the amount of a quota which is fixed every year in a conference between the countries concerned.

"This quota, which was 13,500 tons in 1966, and 12,500 tons in 1967, was raised to 15,400 tons in 1968, an increase which fails to reflect the progress of the French and Senegalese catch."

Discuss Common Policy

"In order to absorb the surplus and avoid flooding the French market for canned fish, the Senegalese Tuna Fishing Company has just agreed to export, during the current fishing season, 1,800 tons of frozen tuna to countries other than France. On the Community level, the search for protection can only result from a common policy. The rules of a common policy which are now under discussion among the member countries provide for a system of price guarantee for tuna which, if adopted, should enable the canners to obtain their fish supplies from the French catch at prevailing world prices, and to secure at the same time a fair income to fishermen.

"It is foreseen that canned tuna, as well as sardines, will be subject to a minimum import price." (Regional Fisheries Attache', U.S. Embassy, Abidjan, Oct. 6, 1969.)

* * *

NEW TUNA SEINER
COMPLETES SHAKE-DOWN

A new tuna seiner, 'Jacques-Coeur,' completed fishing trials in early September 1969 off Concarneau. Third of her class, she was designed for maximum productivity.

She is 154 feet long; 35 feet wide; her 800-hp engine can make 14 knots; daily freezing capacity is 50-60 tons; hold capacity is 375-400 tons; at-sea time is at least 55 days, and she is valued at about US$1.1 million, equipped. Under a new agreement for large tuna vessels, her 18-man crew will rotate so that onefourth will always be on 45-day shore leave.

Could Double Seiner Catch

Jacques-Coeur's fishing grounds are more than 4,960 miles from Concarneau. She is expected to land 2,500-3,000 tons of tuna a year. In 1968, the best catch made by the preceding seiner class was 1,475 tons. ('Le Marin,' Sept. 19, 1969.)

SPAIN

FROZEN HAKE FILLETS PRODUCED
FOR U.S. MARKET

A new Spanish trawler, 'Ila,' is processing and packing frozen hake fillets for the U.S. market. This was reported by the managing director of Congeladores del Atlantico, the trawler's owner. The firm also owns 4 other trawlers fishing off South West Africa. It has about 30 fishing out of Las Palmas.

SPAIN (Contd.):

New Class

The 1,500-gross-ton vessel, completed earlier this year in Vigo, is 249 ft. long and has a 39½ ft. beam. Her engine is 2,670 b.ph. diesel. With a crew of 45, Ila is considerably larger than the earlier class of Spanish trawler now operating off South Africa. She is the first in a series of 8; three are now under construction. Her owners also are building a series of tuna vessels for equatorial waters.

New Export Product

The managing director said Spain is building an important export market for fish products. The new pack being produced by the Ila is expected to prove popular on the U.S. market. ('South African Shipping News and Fishing Review,' Sept. 1969.)

WEST GERMANY

INTEROCEAN '70 SLATED

The advisory committee for Interocean '70 has been named. The chairman is the president of the Deutsche Hydrographische Institut, Prof. Dr. Roll. The committee is scheduled to meet in Dusseldorf or Hamburg in December 1969.

Interocean '70

The Congress will have 6 principal themes: exploitation of the sea's nutritional resources; exploitation of the sea's mineral resources; pollution prevention; application of oceanology to shipping and shipbuilding; protection of the coast and coastal waterways; systems and components for oceanology research and techniques, and 20 sub-themes. Each of the 20 will have a chairman or discussion leader; some already have been selected.

To Obtain Information

Conference languages will be French, English, and German, with simultaneous translation. Requests for further information on authors and papers should be addressed to Dr. Roll or Dr. Weichhardt, Hamburg, Federal Republic of Germany. (U.S. Consulate, Dusseldorf, Oct. 3, 1969.)

HOW MUCH ELECTRICITY DOES AN ELECTRIC EEL GENERATE?

Although the electric eel (which isn't a true eel) is the best known generator of electricity, there are at least 500 kinds of fishes that generate appreciable amounts of electricity. The electrical discharge serves to stun prey and repel attackers.

The average discharge is more than 350 volts, but discharges as high as 650 volts have been measured. Current is low, usually a fraction of an ampere; however, brief discharges of 500 volts at 2 amperes have been measured, producing 1,000 watts. Although direct current is produced, it may be discharged as frequently as 300 times a second.

Severity of the shock depends on the size and state of health of the fish. Voltage increases until the eel reaches a total length of about 3 feet; after that, only amperage increases. Electric eels in South American waters have been known to grow to a length of almost 10 feet.

Other electric fish are found in other parts of the world. ('Questions About The Oceans,' U.S. Naval Oceanographic Office.)

LATIN AMERICA

PERU

ANCHOVY SEASON IS POOR

Peru's Sept. 1969 catch was extremely poor. October showed no improvement. Regardless of cause--oceanographic, overfishing, or other--it's a poor season for the hard-pressed anchovy industry. Despite exceptional prices--$425 per metric ton on Oct. 24--at least one firm, unable to meet its contracts, has gone bankrupt. Strikes for higher wages are expected.

Fish-Meal Production & Export Stocks, Jan.-Sept. 1967-69

	1969	1968	1967
		(Metric Tons)	
Production	1,110,937	1,323,995	1,082,138
Exports	1,368,412	1,478,769	1,123,604
Stocks on hand Oct. 1, 1969	99,908	408,306	313,330

Maybe Catch Pause

Scientists may recommend a catch pause in January and February 1970, but if catch doesn't improve, fishing probably will continue until June. (Sociedad Nacional de Pesquería, Oct. 17, 1969; U.S. Embassy, Lima.)

ECUADOR

DISCOVERS NEW SHRIMP BED

The long-awaited discovery of a deep-water shrimp bed is being proclaimed by exuberant Ecuadorean fishermen. Optimistic early reports placed the bed about 30 miles offshore in 40 to 100 fathoms. It may extend into Peruvian waters south of Manta. Catches of 30,000 pounds by a single boat within two days have been claimed. Catches have been primarily medium, with some large sizes--about 50% brown, P. californiensis, and 50% pink, possibly P. brevirostris.

Record Exports Insured

It is too early to determine the extent of the new find. However, it is certain to insure a record for Ecuador's 1969 shrimp exports. Only companies with large modern refrigerated boats can be expected to benefit. This would include 2 major firms operating with U.S. capital, Empacadora Nacional and Empacadora Alberti. (U.S. Consulate, Guayaquil, Sept. 30.)

CUBA

ACQUIRES 3 FACTORYSHIPS FROM SPAIN

Spain and Cuba have concluded a new exchange agreement. If the Spanish government approves, 'Transimport' of Havana will acquire 3 vessels from a Spanish fleet that has been fishing off South Africa.

The vessels are 'Aracean' and 'Arcos,' owned by Armasur of Cadiz, and 'Pescafria' from Francisco Rodriguez fleet based in Parages de San Pedro.

Vigo-Built Vessels

The vessels, built in Vigo shipyards, have lines for fillet production and fish-meal plants. These Spanish operations, and frozen whitefish production, will be greatly reduced when the vessels leave. After the agreement is confirmed, Spain will build 3 new replacements. ('Industria Pesqueras,' July 1, 1969.)

MEXICO

GULF COAST SHRIMP CONTRACTS SIGNED

Shrimp vessel owners and cooperatives on the Gulf of Mexico have signed a 3-year contract. It became effective Sept. 30, 1969.

Under Mexican law, only members of cooperatives may catch 7 species of fish and shellfish, including shrimp. Although shrimp vessels usually are owned either by cooperatives or private owners, the crew members, in all cases, must belong to a cooperative.

New Contract

Basically, the new contract contains the same provisions as the previous one, except for some increase in payments to the cooperatives.

MEXICO (Contd.):

	Payment in Pesos		
	New Contract	Old Contract	Increase
Payment to Crew--Large Shrimp[1/]	3.45 per kg.	2.99	0.46
Payment to Crew--Small Shrimp	1.55 " "	1.30	0.25
Administration Costs	0.67 " "	0.65	.02
Crew Wages during Vessel Repairs or Dry-docking	83.00 per day	75.00	8.00
Crew's Food	52.00 " "	48.00	4.00

1/Large shrimp are sizes up to, and including, 21-25 (heads-off) a pound.

Note: One peso equals US$0.08. Crew wages are divided among captain, engineer, cook, and winchman.

The contract applies only to the Gulf of Mexico. There is a different contract for the Pacific Coast. There, after deduction of various expenses, 54% of the catch value goes to the cooperative, and 46% to the boat owner. (Reg. Fish. Attaché, U.S. Embassy, Mexico, Oct. 13, 1969.)

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HOLDS 4TH NATIONAL OCEANOGRAPHIC CONGRESS

Mexico's Fourth National Oceanographic Congress was held in Mexico City, Nov. 17-19, 1969.

A general invitation to participate and to present papers had been extended to both Mexican and foreign scientists interested in marine studies. The papers covered: physical and chemical oceanography; marine meteorology; geophysics, geology, biology, engineering, and fisheries.

Latest Equipment Exhibited

The Congress provided an exhibit area for participants and sponsoring agencies to demonstrate marine-science activities and developments. Some of the latest instruments and equipment designed for oceanographic work also were exhibited. (Regional Fisheries Attaché, U.S. Embassy, Mexico, Oct. 13.)

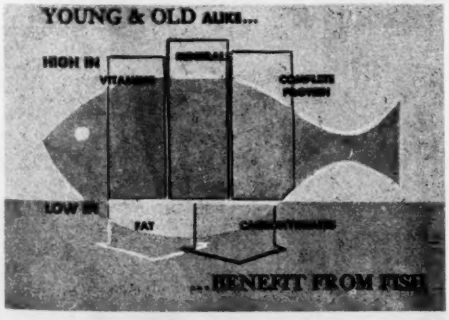
EL SALVADOR

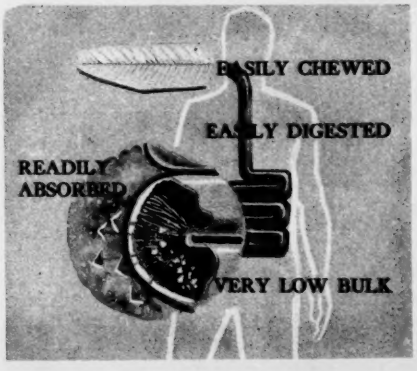
S. KOREANS INVEST IN SALVADORAN DEEP-SEA TUNA PROJECT

In 1968, a Salvadoran Trade Mission visited the Republic of Korea (S. Korea); in February 1969, S. Korean fishery technicians visited El Salvador. As a direct result, S. Korean investors have approved a tuna-fishing development for El Salvador.

US$1 Million Investment

An initial investment of US$1 million, at La Union, reportedly will involve procurement of new docks and warehouses, processing and canning facilities, and larger fishing boats. Some equipment might be supplied by S. Korean manufacturers; probably some will come from other sources, including the U.S. (U.S. Embassy, San Salvador, Sept. 23, 1969.)





ASIA

JAPAN

SOME TUNA LONGLINERS ARE LOSING MONEY

Some tuna longline-vessel owners have been operating at a loss in recent years, according to the National Federation of Japan Tuna Fishery Cooperative Associations (NIKKATSUREN). A NIKKATSUREN study found one-boat owners of 330-360 gross-ton longliners that land their catches in Japan had suffered net losses of about US$13,900 a year from 1963 to 1967.

1967 Compared to 1962

The study uses 1962 as a base year of 100. In 1967, the number of fishing trips a year declined to 73, and catch quantity to 67. Average fish price was 187 but, owing to a catch decline, value of landings was only 126. Sales commissions increased to 122; costs of fuel, water, bait, gear, repair and replacements jumped to 173; and labor to 152. All expenses combined, including taxes, rose to 142. As a result, gross profits in 1967 declined to 81. After deducting depreciation, net losses have run from $11,690-$15,550 a year since 1963.

Dangerous Trend

Equipment and labor costs rose sharply in recent years, while tuna prices, except for bluefin, leveled off. NIKKATSUREN warned that if the trends of the past 2-3 years continue, the very existence of the tuna fishery will be in grave danger within a few years. It urged the government to develop measures to cope with the situation. ('Suisan Tsushin,' Sept. 8, 1969.)

TUNA SEINE FLEET WITHDRAWN FROM EASTERN ATLANTIC

Nichiro Fishing Co. has decided to withdraw its tuna purse-seining fleet from the eastern Atlantic off west Africa. The unprofitable operations and poor efficiency of two-boat seining resulted in cumulative losses year after year. Five pair-seiners and 2 motherships were there in mid-October 1969.

U.S. Seiners Compete

Difficulties were compounded by intense competition from U.S. purse seiners off west Africa. These also sell their yellowfin catches to Italy, till now a very important market for Japan. The efficient U.S. seiners use helicopters to sight fish schools. Each vessel catches 30-50 tons a day.

The Taiwanese, who fish with seiners similar to U.S. seiners, also are reported doing well in the area. Nichiro may build U.S.-type tuna seiners for the eastern Atlantic, primarily to supply Japan's domestic market. ('Kanzume Tokuho,' Oct. 22, 1969.)

* * *

EXPLORATORY VESSEL FAILS TO FIND BLUEFIN IN SOUTHWEST ATLANTIC

The tuna longliner 'Azuma Maru No. 37' (314 gross tons), on a government-subsidized cruise in the southwest Atlantic off Argentina, has been unable to find southern bluefin. Its absence has caused much disappointment. The vessel's scientists now think that southern bluefin spawning grounds may be limited to an area off western Australia.

Earnings & Expenses of 330-360-Gross-Ton Tuna Longliners, 1962-67[1/]

	1967	1966	1965	1964	1963	1962
No. of trips per year	22	23	26	26	28	30
Catch (metric tons)	353	370	430	435	455	526
Average price (US$/Short ton)	552	519	388	353	315	295
				(U.S.$)		
Value of landings	214,940	211,920	183,890	169,170	158,000	170,830
Sales commissions	6,440	7,190	6,440	5,250	4,000	5,280
Equipment cost	55,420	44,810	47,670	38,190	37,420	31,940
Labor cost	80,390	71,670	62,500	57,420	49,390	52,780
Other costs	36,220	33,670	40,780	35,530	35,830	35,830
Subtotal of costs	178,470	157,340	157,390	136,390	126,640	125,830
Gross profit	36,470	54,580	26,500	32,780	31,360	45,000
Depreciation	48,160	2/39,440	41,860	48,330	45,940	46,390
Net profit or loss	-11,690	-15,140	-15,360	-15,550	-14,480	-1,390

1/Average of sample operating units.
2/Unverified.

* * *

JAPAN (Contd.):

Finds Bigeyed Off Brazil

In late September 1969, the vessel proceeded north toward 30 to 34° S. latitude and 53° W. longitude, off Uruguay and southern Brazil, to investigate an area where she had found good bigeyed concentrations earlier in the trip. She will return to Japan by way of Cape Town in March 1970. ('Suisancho Nippo,' Sept. 24, 1969.)

* * *

ALBACORE DISCOVERED OFF KURILS

Pole-and-line vessels fishing skipjack tuna unexpectedly encountered albacore near 40° N. lat. and 160° E. long. off the Kurils, north of Japan. They landed about 3,000 metric tons during late August and early September. The fish were small--around 3 kilograms (9.9 pounds)--but discovering albacore in this region has aroused considerable interest among Japanese tuna packers.

Albacore schools off Japan migrate northward with the Kuroshio current, but they are rarely found off the Kurils. ('Kanzume Tokuho,' Oct. 3, 1969.)

* * *

BERING SEA BOTTOMFISH CATCH INCREASES

The 14 Bering Sea bottomfish fleets caught 627,000 metric tons from Jan. 1 through Aug. 22, 1969, 4% above the 608,200 tons for same period 1968.

Alaska pollock catch dropped about 20,000 tons below the 1968 period because of poor fishing from May to June. It later returned to normal levels, but frozen surimi (minced meat) production will be slightly less than estimated originally.

Since the catch of flounder doubled, total catch for the year should surpass 1968's 843,000 tons. ('Suisan Keizai,' Aug. 26, 1969.)

Eastern Bering Sea Bottomfish Catch, Jan. 1-Aug. 22

	1968	1967
	(Metric Tons)	
Alaska pollock	512,800	493,000
Flounder	40,900	84,900
Cod	30,600	27,700
Silver perch	1,250	3,200
Ocean perch	5,450	5,000
Herring	6,900	10,400
Red shrimp	5,300	2,900
Total	603,200	627,100

* * *

EASTERN BERING SEA CRAB FISHING ENDED

The two 1969 Bering Sea crab fleets ended operations in September. 'Keiko Maru' (7,536 gross tons) and 15 catcher vessels left Bristol Bay on the 15th. 'Koyo Maru' (7,658 gross tons) and her 15 catcher vessels finished on the 28th. Keiko Maru carries 6 portable boats; Koyo Maru 4.

Quotas

The 2 fleets had been assigned a combined king-crab quota of 85,000 cases. This was 48% less than the 163,000 cases in 1968. The tanner crab quota was 16 million, about 17,500 metric tons based on individual crab weight of 2.4 pounds.

Profitable Operations

Bristol Bay yielded good tanner catches from the time fishing began in mid-March. This, and good prices (25% above 1968) on the Japanese market, helped the fleet operators maintain profits despite the 48% king crab cut. Nearly all king crab was canned; all tanner crab was frozen, shell on. ('Suisan Tsushin,' Oct. 2, 1969.)

* * *

ONLY 1 SEINER TO TRY FOR E. PACIFIC YELLOWFIN IN 1970

Only one of the 4 purse seiners that failed disastrously in the 1969 eastern Pacific yellowfin fishery will try it again in 1970. She is 'Hakuryu Maru No. 55.' In early October, she was fishing off west Africa.

Two others, 'Hayabusa Maru No. 3' (275 gross tons) and 'Nissho Maru' (252 gross tons) will abstain. Their owners, Taiyo and Nihon Kinkai Hogei, each lost about US$167,000 to $194,000 in the venture. They now consider these vessels too small for economic operation in the fishery. Each has a carrying capacity of about 90 tons and a daily freezing

JAPAN (Contd.):

capacity of about 20. With less than 10-knot speeds, they also lack mobility compared to the 13-14 knot U.S. seiners.

Taiyo plans to build a 700-800-gross-ton seiner in fall 1970 for the eastern Pacific tuna fishery.

4th & 5th Probably Out

The fourth seiner, 'Gempuku Maru No. 82' (500 tons), probably will not enter in 1970. She has not cancelled her North Pacific purse-seine fishery license, so it is doubtful that she would be able to depart for the eastern Pacific before the end of 1969.

A fifth seiner (210 gross tons) was licensed, but did not enter, the 1969 fishery, and is unlikely to enter in 1970. ('Shin Suisan Shimbun Sokuho,' Oct. 2 & 9, 'Katsuo-maguro Tsushin,' Oct. 6, 1969.)

* * *

MANY COUNTRIES SEEK
JAPANESE HELP IN SHRIMP CULTURE

Many requests from abroad for technical cooperation have been directed to the shrimp research laboratory established by Dr. Motosaku Fujinaga. He is the authority on the culture of "Kuruma" shrimp, a species cultivated commercially in parts of Japan. The requests have come from the U.S., France, Spain, Ireland, Italy, Malaysia, and the Philippines.

In March 1969, South Korea bought 1 million and France 11 million "Kuruma" fry artificially hatched in Japan and shipped by air. About 30% of the French shipment survived the flight.

S. Korean & French Projects

South Korea cultivates the juvenile shrimp in a 3-million-square-meter pond built on an island off her west coast.

France has started a 3-year experimental shrimp-culture project in the Mediterranean. She aims to establish a "Kuruma" farm in Abidjan, Ivory Coast, in 1972. The subsidized Government project is being undertaken by Ajiral (phonetic) Trans-Atlantic Company; Fujinaga's laboratory provides technical assistance. Three Japanese experts now are giving technical assistance. ('Minato Shimbun,' Oct. 9, 1969.)

* * *

U.S. CHINOOK SALMON FRY
DOING WELL IN HOKKAIDO RIVERS

About 500,000 chinook (king) salmon fry (2-3 cm. long) were released in the Yoichi River, Hokkaido, in May 1969. The fry had been hatched from eggs sent by the University of Washington. In late June and July, local fishermen reported catching the smolt (12 cm.) in the Japan Sea near the mouth of the Ishikari River.

In the past, salmon fry have been released in the Tokachi river that flows into the Pacific, but this was the first release into a Hokkaido river flowing to the Japan Sea.

Hokkaido expects to release 4 million chinook fry in the Yoichi in a 5-year program to develop a fishing ground in Ishikari Bay. ('Minato Shimbun,' Aug. 7, 1969.)

* * *

TUNA PACKERS TROUBLED
BY HIGH COSTS & LOW YIELD

Tuna packers in Shizuoka Prefecture (south of Tokyo) are troubled by the high cost of raw tuna and the low meat recovery. In October 1969, they were paying about US$315 a short ton for skipjack (usually packed in oil). However, the fish were so small--about 4.4 pounds--that pack yield was very poor. The packers were considering raising the prices for 7-oz. cans of tuna-in-oil, then quoted at $8.33 a case (48 cans per case) exwarehouse.

Switch to Bigeyed

Because of short domestic supplies, the packers were using increasingly bigeyed instead of skipjack. As a result, the prices for bigeyed were rising daily. Bigeyed imports from South Korea and Taiwan were quoted at US$454 a short ton for dressed-with-tail, and $403 for gill-and-gutted, 50% above the $277 paid earlier in the year.

JAPAN (Contd.):

Albacore Prices

In September, exvessel price in Japan for frozen albacore was $554-580 a short ton, about the same as the c. & f. price for direct exports to the U.S. In October, packers prices for small (8.8 pounds) fish were around $441.

Between the high costs and the poor yield, the Shizuoka packers were said to be losing money. They were canning just to keep going until the fall tangerine canning season began. ('Kanzume Tokuho,' Sept. 26, & 'Suisan Tsushin,' Oct. 9, 1969.)

* * *

RESTRICTIONS ON TUNA IMPORTS URGED

The Federation of Japan Tuna Fisheries has urged the Fisheries Agency to restrict tuna imports. The purpose is to help Japanese fishermen improve their international competitive status. The Federation contrasted the decline in Japan's tuna production during the past 2-3 years with the sharp gains made by South Korea and Taiwan. (The latter's output in recent years has increased 53% a year.)

The Federation explained that these countries, with no tuna markets of their own, definitely will increase their exports to Japan.

Federation's 12 Proposals

Twelve proposals to cope with import growth were presented to the Fisheries Agency. The Federation believes the Fisheries Agency should:

1) Prohibit foreign vessels from landing fish in Japan.

2) Reduce interest rates on long-term loans and raise loan ceilings.

3) Help establish a network of extra-low-temperature cold storages.

4) Improve fishery-law administration and revise some regulations.

5) Study model ship construction to increase economic value and efficiency of fishing vessels, and study vessel leasing.

6) Compensate fishing vessels seized and detained by countries with unilaterally declared extended sea limits.

7) Request South Korea and Taiwan to stop further fleet buildup. Encourage these nations to participate in the tuna scientific meeting proposed during Asian tuna conference.

8) Establish a home-owning system for vessel crewmen and reduce their income taxes.

9) Use imported labor.

10) Reduce wholesale fish market commissions and expand market facilities.

11) Set up council to regulate imports of competitive products.

12) Study feasibility of international management of tuna resource and adopt a country quota system.

7 Longliners Seized

The Federation noted that 7 Japanese tuna longliners have been seized off South America by countries claiming 200-mile limits--Ecuador, Peru, and Chile. Vessel owners have paid enormous fines ranging from US$10,000 to $33,000 per vessel.

The Federation is urging the government to revise seizure insurance to include payment of fines, and to establish a U.S.-type compensation law. It also proposed that economic assistance be extended to the seizing countries in return for assurance that they would not seize Japanese vessels. ('Suisan Tsushin,' Sept. 5, 1969.)

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TUNA CATCHES & EXPORTS DECLINED IN 1968

The 1968 tuna catch was 614,000 metric tons, down 38,000 tons from 1967's 652,000 tons. The distant-water longline catch was 339,000 tons, down 4% from 1967 (354,000 tons). Distant-water catch in the pole-and-line skipjack fishery was 136,000 tons, down 11% from 1967.

Tuna exports in 1968 were 107,078 metric tons, down more than 70,000 tons from 1967 (177,457 tons).

JAPAN (Contd.):

Catch, Average Exvessel Prices and Exports, 1967-1968[1/]

Species	Catch	Avg. Exvessel Price Fresh	Avg. Exvessel Price Frozen	Quantity Exported
	Metric Tons	$/sh. ton	$/sh. ton	Metric Tons
Tuna:				
Bluefin	57,000 (54,653)	922 (786)	648 (612)	194 (1,434)
Albacore	70,000 (97,980)	408 (386)	451 (444)	31,539 (67,546)
Big-eyed	96,000 (105,927)	645 (582)	474 (476)	- -
Yellowfin	116,000 (93,734)	557 (537)	358 (388)	54,653 (78,917)
Young tuna	14,000 (15,030)	- -	- -	6,260 (16,255)
Skipjack	168,000 (181,892)	257 (242)	(fresh & frozen)	14,432 (13,305)
Sub-total	521,000 (549,216)			107,078 (177,457)
Frigate mackerel:	23,000 (29,310)			6 (149)
Billfish:				
Striped marlin	23,000 (23,528)	832 (743)	592 (748)	711 (1,263)
Swordfish	19,000 (18,703)	592 (474)	592 (474)	7,035 (7,194)
Other billfish	28,000 (31,461)	- -	- -	- -
Sub-total	70,000 (73,692)			7,746 (8,457)
Total	614,000 (652,218)			114,836 (186,212)

1/Figures in parentheses are for 1967.

Average exvessel 1968 prices for all species, except frozen yellowfin and frozen big-eyed, were higher than 1967's. ('Suisan Shuho,' Sept. 15, 1969.)

* * *

TUNA IMPORTS ARE INCREASING

Japan imported 19,224 metric tons of frozen tuna during January-July 1969--26.2% over the 15,227 tons imported in same period 1968. Taiwan was the leading supplier, followed by Okinawa and South Korea. Their combined shipments were 16,200 tons, or 84% of Japan's total imports.

Becoming Tuna-Importing Nation

There are indications that 1969 imports will rise to 34,000-35,000 tons. Apparently Japan is fast becoming a tuna-importing nation. Imports have risen steadily over the past 6 years: 851 tons in 1963; 2,452 in 1964; 2,564 in 1965; 10,796 in 1966; 16,184 in 1967; and 28,964 in 1968. ('Nihon Suisan Shimbun,' Sept. 3.)

* * *

TUNA EXPORTS TO ITALY DECLINE

Japan exported 2,239 metric tons of tuna to Italy in September 1969, down from the average of 3,000 tons monthly during June, July, and August. Sales may decline further in October. According to Japan External Trade Organization representatives in Venice, 3,863 tons of yellowfin caught off west Africa by U.S. purse seiners, and transshipped from Abidjan, were delivered to Italy on September 4. ('Katsuo-maguro Tsushin,' Oct. 14, 1969.)

* * *

SEA URCHIN PASTE EXPORTED TO FRANCE

Daiwa Industries, Shimonoseki, has made the first Japanese shipment of sea urchin paste to France.

Daiwa is a leading processor of edible sea urchin paste. It received a French buy offer for 12,000 jars in mid-September 1969. On Sept. 20, it shipped 2,000 50-gram (1¾ oz.) jars priced at about US$0.28 each. About 15,000 jars are to be sent by year's end.

New Product on European Market

About 6 months before, after learning the French eat raw sea urchin roe, Daiwa developed a paste for French tastes. Samples were favorably received. The firm, hoping to develop more markets, also sent samples to Spain, Italy, and West Germany. ('Minato Shimbun,' Sept. 28, 1969.)

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RAISE PRICE OF CANNED SALMON TO U.K.

Earlier this year (1969), the Canned Salmon and Crab Joint Sales Company announced the new offer price of canned red salmon to Britain. Later, the new offer price for canned coho salmon was set at US$22.80/case c.i.f., an increase of about 25% over 1968. The price of canned king salmon had not yet been decided early in August. ('Suisan Tsushin,' Aug. 12, 1969.)

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JAPAN (Contd.):

1968 TUNA SURVEY IN SOUTH ATLANTIC REPORTED

The Japanese Fisheries Agency has released the results of a tuna survey in the central and western areas of the South Atlantic. The Government-owned research vessel 'Shoyo Maru' (604 gross tons) departed Japan Sept. 1968 and returned March 1969.

Cruise objectives were to assess abundance and distribution of tuna, primarily southern bluefin, and to test labor-saving devices.

First Survey Area

The survey began around 30° S. lat. and 10° W. long. in the central South Atlantic and continued west. Surface temperatures ranged from 18.2° C. to 19.2° C. (64.5° F. to 66.5° F.); water transparency was 30 meters or more; no current boundary was observed.

In the first phase, 27 albacore, 2 yellowfin, and 1 bigeyed were taken on 13 longline sets (800 hooks) and four trolling (4 hooks). The albacore were 91-110 centimeters (35.8-43.3 inches) long; these were assumed to be adults, based on a comparison with the Pacific albacore, which mature at around 90 centimeters. The albacores' gonads weighed 30 to 180 grams. This indicated they were not fully developed.

Off Argentina's East Coast

Waters off the east coast of Argentina, within the 200-mile sea limit, were surveyed with the Argentine Government's permission. Three longline operations were conducted in an eastward direction to 51° W. long. around 45° S. lat. Catch composition varied widely, depending on area. Five albacore and 126 sharks were among the important species taken. No southern bluefin were caught. The correlation of southern bluefin distribution and oceanographic conditions, so evident in the Indian Ocean, was not observed in the southwestern Atlantic. ('Katsuo-maguro Tsushin,' Oct. 21, 1969.)

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SAURY (TUNA BAIT) SOUGHT IN NORTHEAST PACIFIC

Saury is the longline-tuna-fishermen's favorite bait. It used to be abundant off Japan, but the supply seems to be shrinking. Fishermen are looking for another supply.

Three Nichiro trawlers have been searching for saury in the northeast Pacific since July 1969. After a poor start, they finally located sizable concentrations off Oregon (U.S.) in September. Fishing began to improve around September 8. Reports from the fleet indicated an abundant resource. The trawlers are 'Akebono Maru', No. 21 and No. 17 (499 gross tons each), and No. 18 (492 gross tons).

Off Oregon

A Nihon Suisan trawler, 'Shinano Maru' (539 gross tons), also was scouting saury unsuccessfully off Japan. Encouraged by the Nichiro trawlers' reports, she proceeded to the Oregon coast about September 24. She made a good catch on her first day.

Fishing Methods

All 4 trawlers fish with 'boke ami' (stick-held dip nets) and make 8-10 sets a day. The medium size (10-12 inches) saury, similar to samples received from the U.S., are usable tuna bait.

Two Groups of Saury

The good fishing has raised Japanese hopes that this resource off the U.S. will support commercial operations. The survey has indicated 2 separate groups of eastern Pacific saury--Aleutian and Californian. The catches off Oregon were Californian. ('Minato Shimbun,' Sept. 28.)

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EXPLORES FOR BOTTOMFISH OFF ARGENTINA

The government-owned research vessel 'Kaiyo Maru' (2,539 gross tons) departed Tokyo Oct. 9, 1969, on a 163-day resource survey cruise to the southwest Atlantic. She is investigating bottomfish resources off

JAPAN (Contd.):

southern Argentina and the Falklands. Six government scientists and 3 industry specialists aboard will conduct fish utilization tests, processing the catches into 'kamaboko' (fish cake) and sausages.

Her Schedule

She was scheduled to call at San Diego, Calif., on October 24. In November and December 1969, she will call at Balboa, Santos in Brazil, and Buenos Aires and Mar del Plata, Argentina. She will return to Buenos Aires in January 1970, call at Cape Town in February, Singapore in March, and return to Tokyo on March 20, 1970. ('Suisancho Nippo,' Sept. 30, 1969.)

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JOINT SHRIMP VENTURES PLANNED IN WEST AFRICA

Three different fishing firms are planning joint shrimp ventures with west African countries. Nichiro Gyogyo and Kyokuyo Hogei will operate in Gambia, and Hokkaido Gyogyo Kosha in Senegal (50-60 French vessels reportedly are fishing shrimp out of Dakar).

The Japanese Fisheries Agency has advised the 3 firms to conduct experimental fishing with 1 or 2 vessels for about a year before entering into joint agreements. The Agency also advised them to consult each other before making contracts to avoid disrupting the market.

Kosha in Gabon

Hokkaido Gyogyo Kosha established a joint shrimp venture in Gabon in January 1969. The vessel 'Kohoku Maru No. 3' (250 gross tons) operated by the joint company reportedly is landing about 1,000 pounds of shrimp (550-660 pounds processed weight) every fishing day. ('Minato Shimbun,' Sept. 20.)

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JAPAN & MAURITIUS LAUNCH JOINT TUNA-PACKING VENTURE

The Japanese Overseas Fisheries Co. and the government of Mauritius will operate a tuna-canning plant at Port Louis. Mauritius requested it. Mauritius already permits the Japanese firm to use Port Louis as a tuna fishing base.

The venture, with an estimated capital of about US$83,000-111,000, will can about 250 tons of tuna-in-oil a month. ('Suisan Keizai Shimbun,' Aug. 26, 1969.)

日本

SOUTH KOREA

TRAWLING IN NORTH PACIFIC FAILS FINANCIALLY

W. P. Appleyard, Project Manager, FAO Advisory Services to Republic of Korea (ROK), reported to FAO Investment Conference, Rome, Sept. 18-24, 1969: "Only through trawling in international waters will Korea increase supplies for domestic markets and improve foreign exchange earnings since her coastal resources are fully exploited and increased fishing effort there would not add significantly to the total catch. Over the last 3 years various Korean companies have been operating in the North Pacific. All have fared disastrously. Poor equipment along with inexperienced management and crews have caused major problems and have almost forced 2 major firms into bankruptcy. Nor do the results obtained (in 1969) by a 9,000-ton factoryship appear more promising.

"Self-contained factory freezer trawlers have a better chance of success in the North Pacific. Recent results of a KMIDC (Korea Marine Industries Development Corporation) freezer trawler of 1,500 tons are encouraging, but it is hoped that the building of larger vessels (some of 4,000 tons are contemplated) will be the subject of detailed feasibility studies and not motivated by 'follow the leader' policy."

More Data in Seoul Paper

Additional data on ROK fishing in the North Pacific were disclosed in a Seoul newspaper. The ROK Office of Fisheries licensed the Korean fleet to fish north of 50° N. and east of 175° W. The total catch for 1969 was planned at 7,000 metric tons valued at 500 million Korean won (about US$1.8 million). The Office estimates that a large (1,500-gross-ton) stern trawler can catch fish worth about 200 million won (US$706,700) in 1 year of North Pacific operations. Operating costs are about 60% of

SOUTH KOREA (Contd.):

total earnings. Net profit could amount to as much as 80 million won ($282,700) per year per stern trawler.

Trawlers Need Support Vessels

According to the newspaper, the "most important thing ROK has learned from her fishing ventures in the N. Pacific is that comprehensive support measures are essential." Small trawlers must have a mothership to service them, and "independent" (nonfleet) stern trawlers must have a supply base. ('Hankuk Ilbo,' Sept. 4, 1969.)

MALAYSIA

FISHERY TRENDS IN SABAH & SARAWAK

There are about 6,500 full-time fishermen and 1,000 fish culturists in Sabah. Fish-processing plants employ about 1,000 workers.

Sabah's catches have grown from about 19,000 metric tons, worth about US$4 million, in 1962 to around 36,000 tons worth close to $9.7 million in 1968. The value of exported fishery products increased from about $833,000 in 1963 to $2.8 million in 1968.

Shrimp

The 3,200-ton shrimp catch in 1968 was worth about $3.3 million. Frozen shrimp exports to the U.S., U.K., Japan, and Europe amounted to 1,540 tons worth about $2.6 million.

Oysters & Cockles Surveyed

Sabah's Ministry of Agriculture and Fisheries is surveying the commercial development of oyster and cockle culture. The mangrove swamps and brackish lakes along Sabah's 900-mile coast reportedly have large oyster and cockle stocks. Oysters could become a major export item.

Sarawak's Landings

Sarawak landed about 13,900 tons in 1968, almost 23% shrimp. Landed value (money actually received by fishermen) was about $3.8 million; retail market value was about $6 million. The Fisheries Department is attempting to reduce costs at the dealer and middleman levels, and increase fishermen's earnings. (U.S. Consulate, Kuching, Aug. 15, 1969.)

TAIWAN

TUNA MARKETING FIRM REACTIVATED

The China Marine Trading Company (CMTC), a Taiwanese tuna-marketing firm, has been reactivated. Established in June 1968, it had been inactive for over a year. Organized with a capital of 30 million yuan (US$750,000), CMTC exports tuna for member firms that own tuna longliners of 200 or more gross tons.

In August 1969, CMTC sold 1,500-2,000 tons of tuna, transshipped from Capetown, to a large U.S. packer. Fish not wanted by the U.S. packer, such as bigeyed and spearfish, were sold on contract to a Japanese trading firm, Tokyo Shosha, for shipment to Japan. Shosha provides tuna bait for Taiwanese fishing vessels. CMTC plans to sell Taiwanese tuna catches landed at Tema (Ghana) to the same U.S. packer.

Taiwanese Prefer CMTC

Taiwanese longline owners favor CMTC tuna sales for two reasons: 1) the tuna catch is sold directly to buyers, and vessel owners get to know export prices; and 2) sales by their own nationals provide a sense of mutual trust.

CMTC's stepped-up sales effort has intensified rivalry with Japanese trading firms handling sales of Taiwanese tuna catches. ('Suisancho Nippo,' Oct. 30, 1969.)

PERSIAN GULF FISHERIES

David K. Sabock and James A. Gurr

Lands of fabled mystery and adventure, the countries bordering the Persian Gulf are rich not only in "black gold" (oil) but in fish and shellfish, especially shrimp.

Several Persian Gulf countries are developing fisheries as additional sources of income to oil--with some success. Such modern techniques and methods that exist generally are found in the shrimp trade. Saudi Arabia, Kuwait, and Bahrain have had the most successful fishery developments and, with Iran, ship large quantities of shrimp to the U.S. Iran has the longest coastline and a large share of the Gulf fishery resources within her territorial waters, but she has done little to exploit them. The Trucial States and Qatar also have resources that could be developed, but projected plans have not yet been fully realized. Iraq has a very short and unproductive coastline and has shown little interest in developing a marine fishery. As a whole, however, the Persian Gulf has virtually unlimited potential for expanded fishery production. A conservative estimate is that the total yield could be increased at least tenfold.

Private companies from the U.S., U.K., Italy, Greece, and Japan have participated in the area's shrimp fisheries. The USSR also fishes in the Gulf.

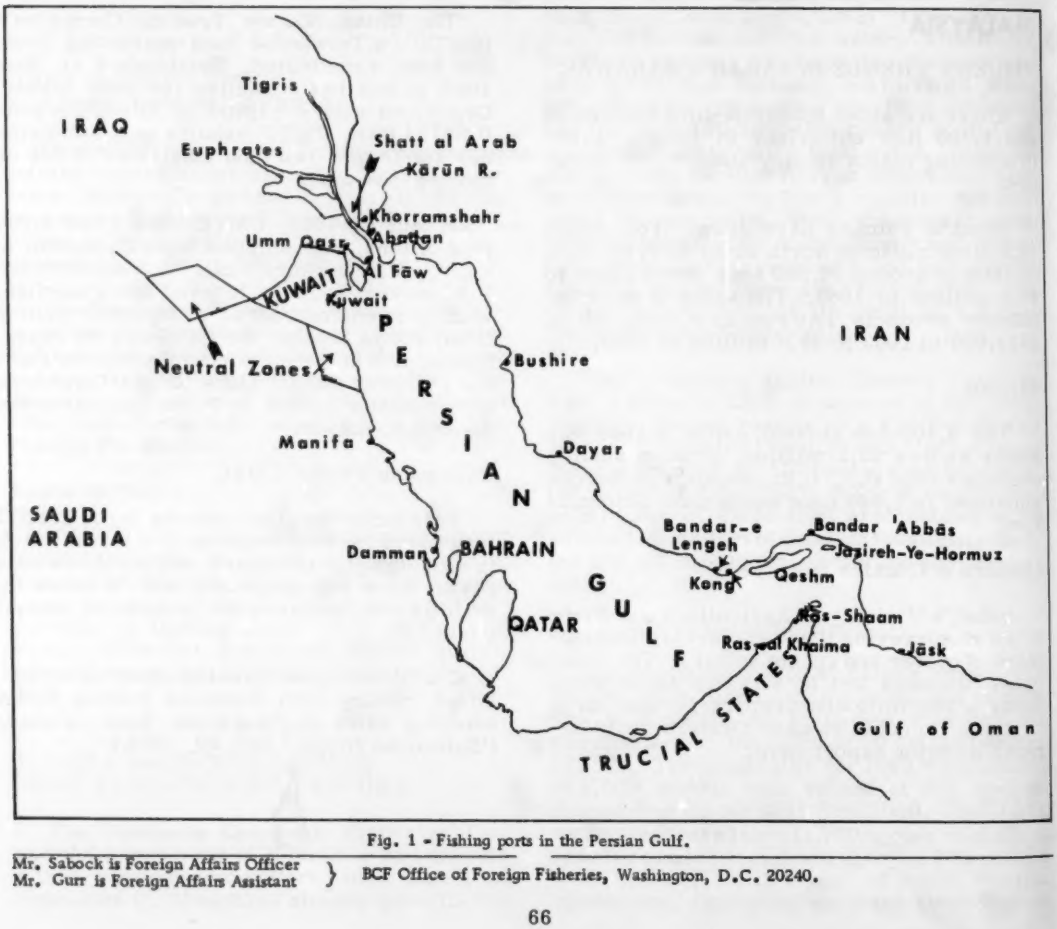

Fig. 1 - Fishing ports in the Persian Gulf.

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CATCHES INCREASING

Total fishery landings in the region are estimated at 75,000-100,000 metric tons (live weight), perhaps up to one-third higher than the total catch in 1960 (table 1). Official statistics are not available on individual species; historical data are fragmentary. The catch is fairly evenly divided among Iran, Kuwait, Iraq, and Saudi Arabia, although it is not known what proportion of Saudi Arabia's catch is taken in the Gulf compared with the Red Sea and Arabian Sea. Relatively small amounts are landed in Qatar, Bahrain, and the Trucial States, a loose-knit group of 7 shiekdoms on southeastern coast of Persian Gulf.

Table 1 - Persian Gulf: Total Fish Landings, 1963-67

	1967	1966	1965	1964	1963
	(1,000 Metric Tons)				
Iran[1]	22.4	21.0	NA	NA	NA
Saudi Arabia	21.6	19.9	18.6	20.2	19.6
Iraq[2]	NA	18.3	12.5	19.2	11.3
Kuwait[3]	13.0	11.0	11.0	10.0	9.0
Qatar[3]	NA	NA	NA	0.6	0.6

1/Includes landings of foreign vessels licensed to fish in Iranian waters.
2/Data refer to wholesale markets only.
3/FAO estimates.
NA - Data not available
Source: FAO Yearbook of Fishery Statistics, vol. 24, 1967.

Although many species of fish and shellfish are caught, shrimp has attracted worldwide attention. Shrimp landings totaled 17,900 metric tons (live weight) in 1967--66% more than in 1964.[1] Saudi Arabia, Kuwait, and Iran, in that order, are the primary producers. Despite a large increase in world catch from 1964 to 1967, Persian Gulf countries have increased their share of world total from 1.8% to 2.6% (table 2). Industry estimates for 1968 indicate landings of about 20,000 tons, with 1969 results running at a comparable level. In 1965, catch per vessel peaked at 260 tons. Since then, the per-vessel catch has declined to less than 160 tons, while the number of vessels has increased.

MANY SPECIES AVAILABLE

Many species of demersal and pelagic fish abound in the fertile waters. Generally, the species are marine coastal types and include sea breams, snappers, pomfrets, mackerel, skipjack, spadefish, croakers, groupers, grunt, threadfin, gizzard shad, shad, yellowfin, shrimp, and many others. The shrimp is generally "pink," with a life cycle of 12-14 months.

Table 2 - Shrimp Landings (Live-Weight), 1964-67

	1967	1966	1965	1964
	(1,000 Metric Tons)			
Iran	4.1	4.6	-	-
Kuwait	6.0	4.0	4.0	3.8
Saudi Arabia	7.8	7.1	6.6	7.0
Total	17.9	15.7	10.6	10.8
World Catch	690.0	626.0	587.0	590.0
Percentage of World Catch	2.6%	2.5%	1.8%	1.8%

Source: FAO Yearbook of Fishery Statistics, vol. 24, 1967.

PRIMARY FISHING AREA OFF IRAN

Fish and shrimp are found over a wide range, although more surveys are required to pinpoint additional commercially exploitable concentrations. The primary fishing area is off Iran. There, the Gulf's deepest part exists, and the flow of numerous streams into the Gulf results in much food.

The entire Gulf is rich in marine resources, but emphasis is on fishing in nearby, shallow coastal waters. This is only because sufficient vessels are not available to conduct distant fishing operations. Distant-water vessels are usually employed in shrimping.

Large concentrations of tuna, Spanish mackerel, sardines, and others, occur during September-March in the southern area from the Straits of Hormuz to Qatar. An influx of colder, less saline, more fertile water from the Gulf of Oman into the Persian Gulf carries with it large numbers of these fish. The primary fishery in this area occurs between Ras-Sha'am and Ras-al-Khaima. It is there that the deepest part of the Persian Gulf is close to the Trucial States. During the remainder of the year, fishing is conducted for shallow-water or bottomfishes for local markets.

Good catches are also made in the northern end, near Shatt al Arab, where the waters are enriched by the Tigris, Karun, and Euphrates rivers. The fishing grounds off Bushire and the island of Jazireh-Ye-Hormuz are among the best.

Shrimp are the principal off-shore species taken and are widely distributed. Main concentrations are in the northern, eastern, and southern sections and in the extreme northern part of the Gulf of Oman. The Iranian coast harbors the most valuable shrimp concentrations. Iranian shrimping centers are in the Shatt al Arab and Bandar 'Abbas regions.

1/The total shrimp catch probably is higher than that reported by official sources. Some catches are directly off-loaded and transshipped at sea and, therefore, are not recorded as landings.

Much of Saudi Arabia's and Kuwait's shrimp catch is taken near the coast of Iran. The Trucial States are not near the major shrimp fishing grounds. Fair quantities are harvested in Bahrain's coastal waters. The species Penaeus semisulcatus is found in the Gulf's northern part down to Qatar. Penaeus merguensis are centered on the Gulf's eastern shore, generally near Iran's Bandar 'Abbas region.

FISHING SEASONS VARY

Large-scale fishing is conducted throughout the Gulf from September through June. September-May is the main shrimp season. From September-March, mackerel, sardines, tuna, sailfish, kingfish, and marlin are readily available; a peak is reached in November-January. Pelagic fishing is at a low ebb during the hot summer. Fishing then is based on shallow-water and bottomfishes, such as rockcod, seabream, snapper, grunts, and horse mackerel.

FISHING VESSELS: CANOES TO MOTHERSHIPS

Standard fishing vessels are small rowboats, canoes, and sailboats. Although no exact data are available, it is reasonable to assume that these number in the thousands. Despite the heat, most vessels do not carry ice.

About 200 modern shrimp trawlers, with 6 large motherships, work the Gulf. Shrimp trawlers have been built or ordered from Norway, Pakistan, W. Germany, France, Mexico, USSR, and the U.S. Most are about 55'-62' length overall (l.o.a.) of many tonnages; the average likely is about 150 GRT. The motherships are as large as 4,000 GRT. About half the shrimp trawlers are based in Kuwait as a result of that country's early concern for developing a viable shrimp industry. Iran has not developed a large motorized fleet despite its long coast (800 miles) or nearness to the richest Gulf fishing area.

The same types of native vessels are common throughout the Gulf, although the names vary. Iranian names are used in this article. The smallest are the huris, dugout canoes 19 to 22 feet long with 1 to 3 fishermen. They are used to tend traps and to fish with hand lines. Next in size are the small sailing boolams (29-32 ft.) with removable coverings made of palm-leaf ribs. These carry 6 or 7 men and are used to set drift and seine nets for smaller fish. The shahrestan-e minab boats are larger (up to 49 ft.) and have removable decks of wooden boards. They carry 12 to 30 men and are used to fish for tuna and sardines with drift gill nets. Largest native boats are the chah bahar, broad-beamed, 32-96-foot sailboats. They carry 12-15 men and are used in gill-net

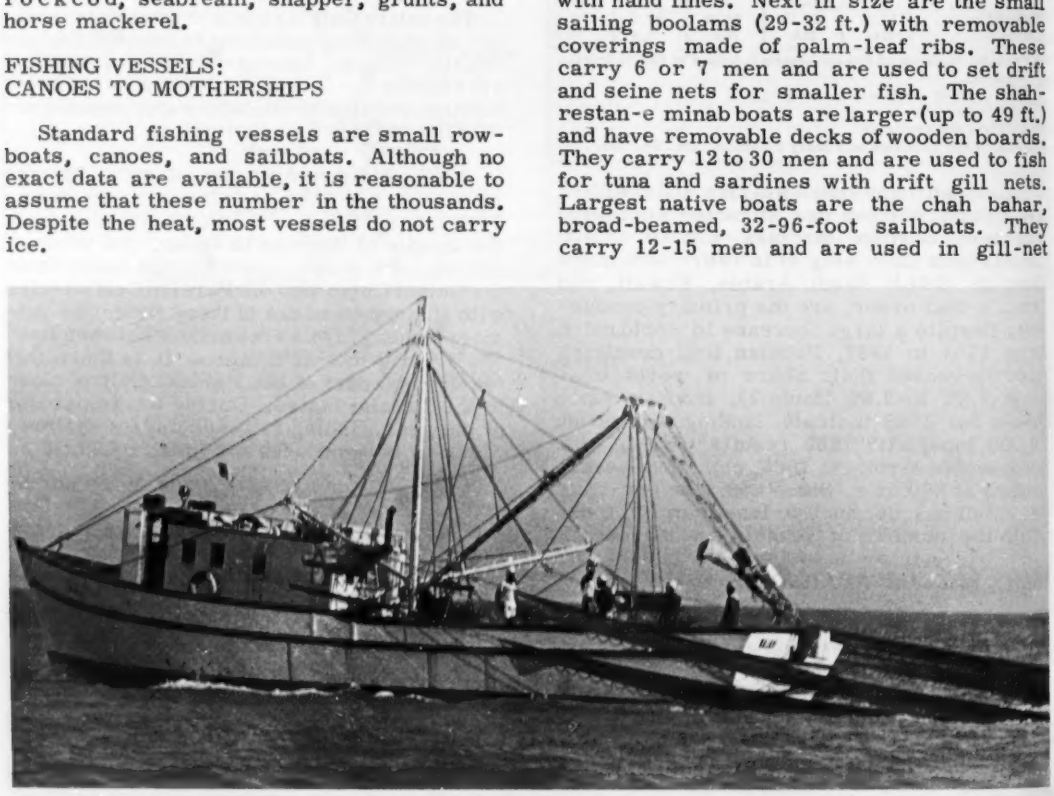


Fig. 2 - Saudi Arabian trawler.

fishing for tuna and kingfish. Except for the small huris, most boats are well constructed and seaworthy. The larger ones are suitable for mechanization.

MANY FISHING PORTS

Numerous fishing ports exist but none is well developed. Lack of fresh water and ice-making facilities and inadequate storage and distribution facilities are several principal deficiencies. In many instances, fish are landed at protected areas along beaches.

Primary Persian Gulf ports in Iran include Bushire, Abadan, Khorramshahr, Dayar, Bandar-e Lengheh, Kong, and Bandar 'Abbas.2/ Bandar 'Abbas, where Persian Gulf and Gulf of Oman meet, is probably the most modern Iranian port. Located near the important shrimp, tuna, and sardine fishing grounds, it is developing quickly. Some 50 vessels are berthed at this port. The only fish-processing plant in Iran is the Southern Fisheries Co. canning plant in Bandar 'Abbas. There is a highway link to interior cities.

Kong is Iran's only boatbuilding yard. Most vessels constructed there are about 30' l.o.a., with small engines, however, vessels up to 200 GRT have been built.

Abadan and Khorramshahr are on the Karun River, about 100 km. inland from the Gulf. Both have good harbors and rail and highway access to other areas. A large cold-storage facility (capacity 160-180 tons) is located in Khorramshahr. Shrimp vessels are provisioned from it by small coastal freighters.

Bushire (or Bushehre) is an important shrimp and finfish port; 90 vessels fish out of it. Large landings support the 3 local ice-making plants. Only about a dozen vessels operate from Dayar, a small port with few facilities. Bandar-e Lengheh has declined in importance and its facilities are inadequate. Over 200 vessels fish tuna and sardines from Jask, a major port on the Gulf of Oman.

Iran has a very short coastline and very few port facilities. Except for the river towns of Al Faw and Umm Qasr in the Shatt al Arab region, beaches are the only places for landing fish.

The city of Kuwait is the largest and most highly developed port on the Persian Gulf. It handles more fishing commerce than any coastal city in the other countries.

Damman and Manifa are the chief fishing bases along the coast of Saudi Arabia's Eastern Province. The shrimp processing and freezing installations there are expanding rapidly with commercial success. The poor handling facilities of the port of Damman has hindered the industry somewhat, but efforts are underway to improve the situation.

Encouraged by the Saudi shrimping success, the shiekdoms of Bahrain and Qatar are also developing commercial shrimping industries. Foreign capital has been invested in developing modern fleets and processing facilities on the island of Bahrain and on the Qatar peninsula.

Commercial facilities along the 300-mile Trucial coastline, from Qatar to the Straits of Hormuz, remain rather primitive. The vessels are similar to native craft used along the corresponding Iranian coast. Most fish are used locally, but some are dried for export to Ceylon and Singapore.

FISHING METHODS MOSTLY PRIMITIVE

Gulf fishermen use a wide variety of fishing gear. Modern trawlers, introduced only recently, were first used extensively by Kuwait. Saudi Arabia and Bahrain followed with imported mechanized vessels. However, the most prevalent methods are still primitive. Fish traps, shore seines, drift nets, gill nets, cast nets, and handlines are common. Dynamiting and poisoning are also used.

Shore seines, drift nets, and gill nets are used along the beaches for catching sardines and herringlike fishes. These nets are fairly large, frequently up to 320 meters long.

Cast nets and handlines are used by individual fishermen for many varieties of fish, but yields are smaller than the others.

Occasionally, fishermen use a "fish poison" of toxic lilac-tree seeds pounded up with dead crabs and small fish. This is spread over shallow water when the tide is bringing in fish. After eating this mixture, the fish come near the surface and go into spasms. The fishermen then go into the water and catch them by hand. Actually, this is not a destructive practice because the drug's effects do not last long.

2/Andersskog, Bjorn. 'Report to the Government of Iran on the Southern Co.', FAO, Rome, 1968.

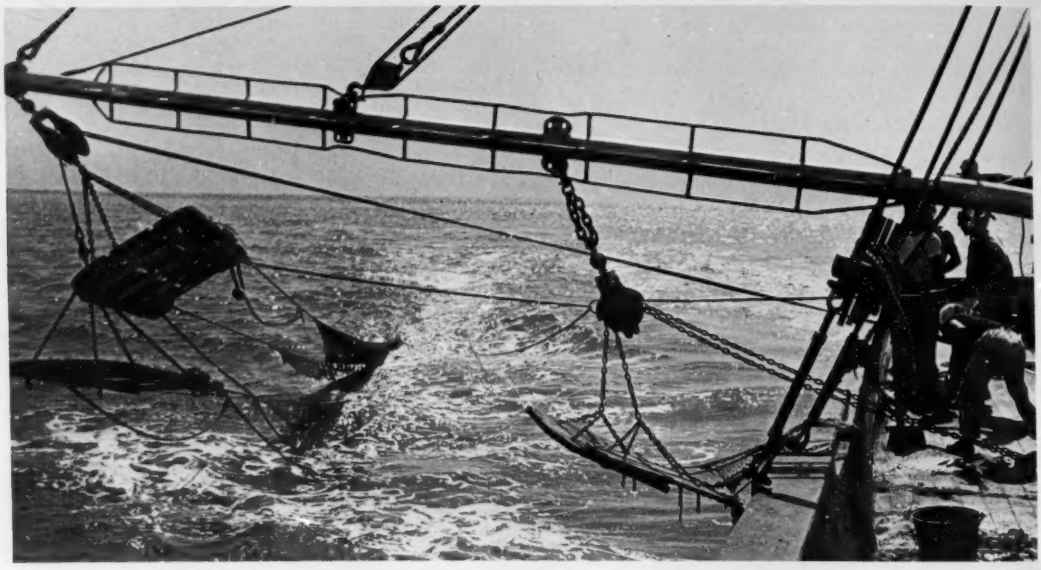


Fig. 3 - Hauling the nets.

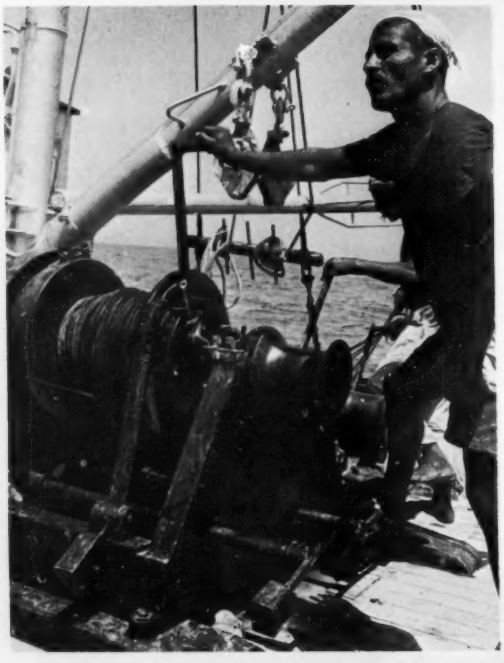


Fig. 4 - Man at winch guides net onto deck.

Fig. 5 - Emptying the net.

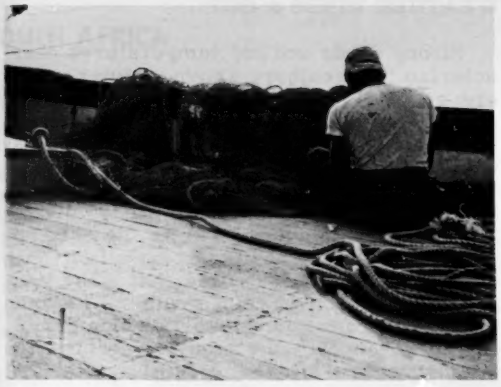


Fig. 6 - Homeward bound fisherman mending nets. (Photos: Ali Khalifa)

PROCESSING & MARKETING PROBLEMS

Processing and marketing techniques in Persian Gulf countries are modern only for the shrimp export industry. Fishery development plans all have as important objectives the modernization of processing facilities (i.e., ice production, cold-storage facilities) and better marketing methods. At present, however, marketing and processing are primitive, equipment old, and hygienic conditions suspect.

Fish is not an important item in the diet of Persian Gulf countries. Fresh fish and dried fish are popular forms for domestic consumption; fish is an important food only in coastal areas. Frozen fish are not an important market form. Some fish are smoked or salted for marketing.

Relatively little fish canning, if any, is done in any Persian Gulf Country except Iran. There, the plant at Bandar 'Abbas operated by the Southern Fisheries Co. cans tuna and sardines for domestic use and export to nearby countries. Its output has reached 33 tons a day. It has a 180-ton cold-storage area and plans to expand this. The plant closes from June through August because of extreme heat.

The most modern processing and distribution techniques and facilities are in the shrimp business, oriented primarily towards the U.S. Most of the processing--grading, cleaning, freezing, and packing--is done on board factory ships in the Kuwaiti and Iranian fisheries. Shrimp are not deveined until processed in the U.S. Sanitation methods and quality are reported to be equal to U.S. standards. In both countries, however, shore-based plants and cold-storage facilities are in operation. In Saudi Arabia, most processing is done at Manifa and Damman. However, there is a factoryship operation with packing, freezing, and storage.

FOREIGN TRADE SMALL

Foreign trade in fishery products, including imports and exports, is not significant. The notable exception is shrimp exports to the U.S. These have increased from 1.4 million lbs. in 1960 to 19.2 million lbs. in 1968 (table 3). Shrimp exports were 10% of total U.S. shrimp imports in 1968 and worth US$14.4 million. This area ranks only behind Mexico and India as leading supplier of shrimp to the U.S. Japan also is becoming an important market.

Kuwait is the area's main U.S. supplier. She increased shipments from only 146,000 pounds in 1960 to almost 9 million pounds in 1968. Saudi Arabian exports to the U.S. increased from 77,000 pounds to 3.7 million during the same period. Shrimp exports from Bahrain, which began with a modest 51,000 pounds in 1962, totaled 4.4 million pounds in 1968. Iranian shrimp exports have been erratic. These varied between 87,000 lbs. in 1963 and 9.1 million pounds in 1966--but fell to 2 million pounds in 1968.

Table 3 - U.S. Shrimp Imports from Persian Gulf Countries, 1960-64 Average, 1965-69

Country	1960-64		1965		1966		1967		1968		1969 (Jan.-Aug.)	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
	1,000 Lbs.	US$ 1,000	1,000 Lbs.	US$ 1,000	1,000 Lbs.	US$ 1,000	1,000 Lbs.	US$ 1,000	1,000 Lbs.	US$ 1,000	1,000 Lbs.	US$ 1,000
Iran	934	496	6,800	4,400	9,106	7,371	1,674	1,212	2,016	1,680	1,603	1,597
Kuwait	1,968	1,330	5,818	3,829	5,744	4,203	8,053	6,229	8,960	6,653	1,660	7,748
Saudi Arabia	121	60	1,201	677	1,622	1,026	2,427	1,347	3,709	2,320	1,444	1,163
Bahrain	10	8	-	-	126	98	1,640	709	4,430	3,684	96	96
Arabian Peninsula	7	2	61	30	12	8	-	-	68	45	973	1,006
Total	3,040	1,896	13,880	8,936	16,610	12,706	13,794	9,497	19,183	14,382	5,776	5,610

SHALLOW & WARM PERSIAN GULF

The Persian Gulf is an area of about 70,000 square sea miles with a coastline of 1,740 sea miles. The coastlines of bordering countries are: Iran, 720 miles (260 of them on Gulf of Oman); Iran, 30 miles; Kuwait, 80; neutral territory, 40; Saudi Arabia, 240; and Trucial Oman, 630.

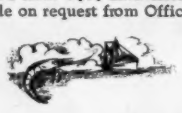
The Persian Gulf is a shallow, warm, salt-water body. Its average depth is about 35 meters. Near Shatt al Arab, at the northern end, the water is extremely shallow and there are extensive tidal flats. There also are mud flats east and west of Al Qatar, north and west of Qeshm Island, and at the northern end of the Straits of Hormuz. The Gulf's channel, ranging in depth from 40-50 fathoms, is along the Iranian coast. The bottom there, and in the delta of Shatt el Arab, is soft mud and clay. Along coastal regions, sand, coral, shell, and gravel interspersed with numerous coral reefs make up the bottom sediments. Coral reefs are especially numerous along the shallow southern coast.

WEATHER WINDS & HOT

Strong winds and hot temperatures characterize the weather. During winter, winds are generally light except for unexpected squalls. Squalls become more frequent in March and April when south and southwesterly winds come in. From gentle breezes early in the day, the winds freshen in the afternoon. It is hot in June and July, with winds variable from west and southwest. A swell caused by southerly monsoon coming from Gulf of Oman can result in turbulent seas that make fishing difficult even in calm weather. Later in the year, strong southeasterly winds arrive, and these support the monsoon swell. The weather calms after mid-August with light breezes in afternoon. From mid-September, weather clears, winds are light, and the southerly monsoon swell decreases.

In the summer, land temperatures are consistently over 100° F., water temperature varies from 90° F.-100° F. These conditions affect fishing in many ways. The techniques used to catch and store the fish, and the machinery aboard vessels, must be adequate to cope with extremely high temperatures.

Note: Information sources for this article include reports from U.S. Embassies and consulates, articles in trade journals, FAO reports, and other sources. A 49-entry bibliography is available on request from Office of Foreign Fisheries.



IS THERE ANY DANGER OF OVERFISHING?

In some areas of the world, overfishing is already a problem for some species. Stocks have been depleted in heavily fished areas such as the continental shelves of Europe, particularly the North Sea. Cessation of fishing during two World Wars proved that a decrease in fishing could result in an increase in the number of large specimens.

The U.S. Bureau of Commercial Fisheries has listed the following species as being seriously depleted: Pacific sardine, Atlantic salmon, Atlantic sturgeon, blue whale, fin whale, Atlantic shad, sperm whale, humpback whale, oyster, and sea otter. Depletion of these species is not caused entirely by overfishing; disease, predators, and water pollution all take their toll.

When the catch of a species reaches the point where the reproductive capacity is unable to compensate for the losses sustained, the species is headed for extinction. However, before this point is reached, operation of fisheries becomes uneconomical, and fishing of many species to extinction is thus prevented.

There is little agreement among fisheries experts on how much the world's fisheries could be increased. Estimates of the percentage of potential yield have varied from 1 percent to 75 percent. Undoubtedly the fish catch could be increased through exploitation of areas in the Southern Hemisphere and through fishing for species not now widely used for food. ("Questions About The Oceans," U.S. Naval Oceanographic Office.)

AFRICA

SOUTH AFRICA

FACTORYSHIP MOVES TO INTERNATIONAL WATERS

The factoryship 'Suiderkruis' is being geared to fish anywhere in the world, not just in South and South-West African waters. She may venture as far as the North Sea and the Newfoundland fishing grounds and compete with Soviet, Japanese, and Portuguese fleets. The ship, and her fleet of small trawlers, already have made a successful pioneer long-range fishing trip off the bulge of Africa.

Catcher Boats Too Small

The catcher boats used by Suiderkruis off North Africa were drawn from the South African fishing fleets. They are too small to be used off the African bulge, which is lashed by northeast trade winds. A company official said: "The spirit of the men was fantastic after their long trip. After sailing almost 5,000 miles in small 72-ft. boats . . . not suited for these stormy seas, there were hardly any incidents when the men came ashore."

To Buy New Catchers

The official added: "We are buying some of the most modern catchers in the world, which will enable us to fish anywhere from the Arctic to the Antarctic." The first 4 or 5 will be built in Norway. Possibly, others will be built in Spain, or elsewhere. They will be steel, about 320 tons--much bigger than the South African boats--centrally heated and air-conditioned.

Based at Las Palmas

Two of the new Norwegian catchers should be in Las Palmas now. Suiderkruis, with full support from the Spanish authorities, is being allowed to use Las Palmas as a permanent unloading port. The S. African company has made Las Palmas its northern base.

Good Distant-Water Catches

In the first 2 months after Suiderkruis sailed from South African waters, the fleet caught 14,300 long tons. These yielded 3,000 tons of fish meal. Fishing was mostly a probing operation. The vessel kept moving instead of fishing one area for some time. Fish were caught in deep water 50 miles south of the Congo for 2 or 3 days. Then the fleet moved round the bulge of Africa. At times, Suiderkruis found herself among 93 boats from 7 nations. She was scheduled to spend 2-3 months off North Africa before returning to South-West African waters. ('Sunday Times,' Cape Town, Oct. 26, 1969.)

* * *

FACTORYSHIPS DO WELL OFF NORTHWEST AFRICA

South Africa's two industrial fishery factoryships, 'Willem Barendsz' and 'Suiderkruis,' were sent to fish off Spanish Sahara during South and South-West Africa's closed fishing season. Both ships left South African waters early in September to cruise off Northwest Africa.

Suiderkruis' Success

The Suiderkruis found fishing promising and will remain in the area for several more months. She unloaded 3,000 short tons of bulk fish meal at Las Palmas in early October and returned to the fishing grounds.

The Barendsz

Owners of the Willem Barendsz said only that the closer the ship was to Las Palmas, the better the fishing. ('Cape Argus,' Oct. 11, 17, 1969.)

SOUTH & SOUTH-WEST AFRICA

CATCHES DROP

The 1969 fishing season presents a mixed picture. While higher meal and oil prices seem likely to push inshore industry earnings to about US$1.4 million ($1.2 million in 1968), there are signs that the Southeast Atlantic resource is being overfished. The factoryships fell short of their combined quota of 570,000 short tons of fish. They caught only 519,000 tons. They now have ventured into international waters.

SOUTH & SOUTH-WEST AFRICA (Contd.):

Spiny Lobster Canning Drops

When only two months remained in the season, the spiny lobster industry reportedly had canned only about half of 1968's total of 554,000 cases (20 lbs. a case). Finally, the local trawl fishery, facing heavy foreign competition, has indicated a further catch decline. This spurred calls for government assistance. (U.S. Consul, Cape Town, Oct. 28, 1969.)

TANZANIA

LAKE VICTORIA LANDINGS RISE

In 1967, Lake Victoria fishermen caught 43,752 short tons of fish. In 1968, the catch increased 35% to 59,853 tons worth US$5,635,492. The catch was composed of 23,742 tons ($2,415,593) from the Mwanza region; 25,215 ($1,817,860) from Mara region; and 10,896 ($1,402,039) from West Lake.

Species & Gear

The catches included 13 different species. Haplochromis led with 21,063 tons; Tilapia zillii trailed with 725. The catches were made by 11,517 fishermen in 2,538 canoes, using 80,573 gillnets, 616 seine nets, and 296,500 long lines. This was an increase over 1967 of 3,104 fishermen, 723 canoes, 7,536 gillnets, 462 seine nets, and 157,798 long lines.

Mechanization

Only 166 canoes had outboard engines in 1967; in 1968, there were 304--189 in West Lake, 93 in Mwanza, and 22 in Mara.

Fishermen's Income

Average income for fishermen in each of the 3 regions was $794 for a 5.53-ton catch in West Lake, $486 for 5.59 tons in Mara, and $402 for 4.44 in Mwanza. ('Mwanza Regional Fisheries Officer's Annual Report, 1968', U.S. Embassy, Dar es Salaam, Sept. 26.)

SOUTH PACIFIC

FIJI

TUNA LANDINGS RISE IN 1969

South Pacific tuna fishing has been generally good this year, although landings have declined since late August after season's peak had passed. From January through July, 4,700 metric tons of tuna were landed--80% of total 1968 landings (5,800 tons).

The Fleet

Twenty-nine vessels are based at Fiji--9 of Minami Taiheiyo Gyogyo (Japan), 18 of Korean Fisheries Development Corporation, and 2 Taiwanese vessels from separate companies. The catch is 80-85% albacore, and about 1% yellowfin. The high-priced albacore catch is greater than the others, so fishermen's profits have been good.

Prices

August prices, per metric ton: US$448 for frozen albacore, $432 for chilled albacore, $361 for frozen yellowfin, and $331 for chilled yellowfin. ('Suisancho Nippo,' Sept. 4, 1969.)

AUSTRALIA

TAIWANESE VESSEL SEIZED

The Taiwanese fishing vessel 'Fu Chih No. 1' was seized inside Australia's "territorial limit" on August 29, 1969. Australia claims a 12-mile fishing limit and a 3-mile territorial sea. Captain and crew were fined US$2,775. The vessel was permitted to leave after the Taiwan Embassy in Canberra guaranteed payment.

She sailed on September 3, but was apprehended again on Sept. 16 fishing inside the limit off North Queensland. This time the skipper was fined $1,100 but no charges were pressed against the crew. On Sept. 30, she departed for Taiwan. (U.S. Consulate, Brisbane, Sept. 4, 17; Oct. 1, 1969.)

SHRIMP FARMING ANYONE?

BCF is conducting research to put the harvesting of shrimp on the same basis as rice, dairy, and poultry farming. This research, called shrimp mariculture, is carried out at the Bureau's Biological Laboratory in Galveston, Texas.

Three species of Gulf shrimp--brown, pink and white--make up the bulk of all shrimp landed in the U.S. The shrimp fishery is the most valuable of all U.S. fisheries. In 1968, landings of 292 million pounds were worth about $113 million to fishermen. About 70% of this catch came from the Gulf of Mexico.

Consumer demand for shrimp, either as food or bait, is increasing at a rapid rate. But landings of shrimp from the Gulf of Mexico, with few exceptions, have remained relatively constant over the past 10 years. The increased demand for shrimp is reflected by increased imports. To supplement this important fishery, and to offset rising imports, BCF began studies in 1964 to determine the economic feasibility of shrimp farming. Although shrimp mariculture has been common abroad for many years, notably in Japan, it is still on an experimental basis in the U.S.

BCF biologists periodically sample shrimp grown in 1/16-acre ponds at Galveston, Texas, to obtain information on length and weight increases. These data will help determine the economic feasibility of shrimp farming in the U.S.

Studies underway may be divided into larval shrimp culture and juvenile shrimp culture. The young shrimp, immediately after it hatches, is called a larva and is free floating in the water. The older, juvenile shrimp, however, lives on the sea floor. The physiological requirements of larval and juvenile shrimp vary considerably; each phase of research has separate and distinct problems related to the age of the shrimp.

Culture of Larval Shrimp

Until a few years ago, Gulf shrimp had never been hatched and reared to the juvenile stage in the U.S. Bureau scientists have now developed techniques whereby thousands of penaeid shrimp can be reared from eggs deposited in the laboratory.

To obtain spawning stock, biologists aboard chartered shrimp vessels collect female shrimp that are ready to spawn. Each female carries between 500,000 and 1,000,000 eggs. In the laboratory, the shrimp usually spawn during the first or second night of captivity.

Initially, because of many problems, only a few shrimp could be reared from eggs spawned in the laboratory. The biggest problem was finding a suitable food that could be grown in large quantities. Larval shrimp are about 1/100 to 1/5 inch long and feed, in part, on tiny marine plants called phytoplankton. Today, after months of experimenting with different marine plants and various kinds of water, biologists in Galveston can grow large amounts of phytoplankton for shrimp food. As the larvae become older, brine shrimp, (artemia) also are used as food.

Additional refinements in larval culture have permitted Bureau biologists to supply small shrimp to nonprofit research organizations involved in other phases of shrimp mariculture.

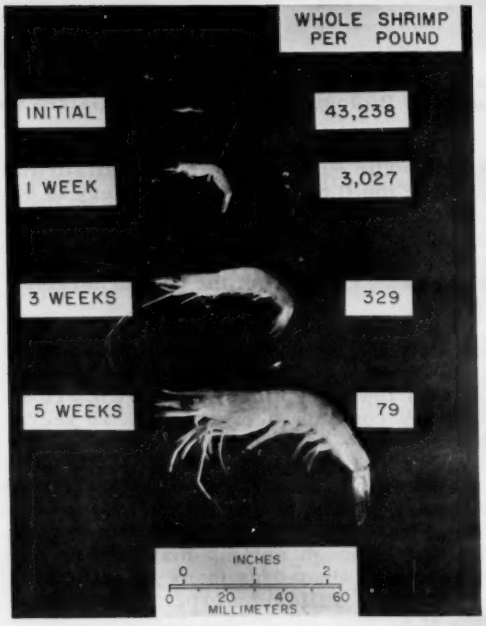
(Continued following page.)

Culture of Juvenile Shrimp

Shrimp reared to about ½ inch in the laboratory have been stocked at varying densities in ponds. Two methods have been used to induce growth in shrimp. One was to feed shrimp daily a prepared diet of ground fish and shellfish mixed with commerically produced livestock food. Shrimp fed the prepared diet grew to about 4 inches in 3 months, or at a rate of about ½ inch every 12 days. When harvested, the greatest yield was about 234 pounds of whole shrimp per acre.

The other method used to induce shrimp growth was to fertilize the ponds. This stimulated the growth of organisms that occurred naturally in brackish waters, and provided food for the shrimp. Shrimp 1 inch long grew to about 4 inches in 5 to 6 weeks, or at a rate of about ½ inch every week. The greatest yield was 575 pounds of whole shrimp per acre.

BCF Biologists found, however, that growth stops when the shrimp are about 4 inches long. It is not known whether this retarded growth is the result of some physiological requirement not met in the ponds, or to a change in diet.



Growth of white shrimp (Penaeus setiferus) over a 6-week period in an artificial environment. These shrimp were "farmed" in a fertilized, brackish water pond at the BCF Biological Laboratory, Galveston, Texas. BCF scientists are developing an economical prepared food that will sustain rapid growth of shrimp in ponds.

Although the results of experimental shrimp farming are promising, future Bureau studies will be made to: (1) develop an economical prepared food that will sustain rapid growth of shrimp in ponds; (2) develop methods to induce shrimp maturity and spawning and to control time of spawning; (3) develop fast-growing shrimp that have favorable tail-weight to head-weight ratio and are disease resistant and hardier than wild shrimp; (4) determine which diseases and parasites occur in shrimp and develop means to control them. (National Marketing Services Office, Bureau of Commercial Fisheries, United States Department of the Interior, 100 E. Ohio Street, Room 526, Chicago, Illinois 60611.)

FOOD FISH FACTS

BLACKBACK or WINTER FLOUNDER
(Pseudopleuronectes americanus)

FLUKE or SUMMER FLOUNDER
(Paralichthys dentatus)

Flounders, an important year-round food fish, are members of a large family of flatfish which includes winter flounder, summer flounder (sometimes called fluke), starry flounder, yellowtail flounder, and a wide variety of soles and dabs. Flounder, highly prized by sport as well as commercial fishermen, weigh from $\frac{1}{2}$ to 5 pounds. The summer flounder, however, weighs up to 15 pounds.

DESCRIPTION

Flatfish could well be called the clowns of the sea. Although they come in a variety of sizes, all of them are bizarre in appearance. Born upright with normally placed eyes, young flatfishes soon find their skulls beginning to twist and one eye moving toward the other side. At the same time the fish begins to tilt. Within a short time both eyes peer from the same side and the fish swims with the eyeless side down. Not all flatfish twist in the same direction, some twist toward the right and some toward the left. As an example, the blackback is a righteye flounder and the fluke is a lefteye flounder. As the head and eyes twist, the mouth becomes d i s t o r t e d and the flatfish "ever after wears a crooked, pained look." (National Geographic)

Flounder resemble flying saucers as they ripple and glide through the water. Part of nature's camouflage is the way they glide to the bottom and then flip sand over their backs, becoming almost invisible except for their protruding eyes. When a small fish or other prey is spotted, the flounder, with a squirt of water from the under-side gill, jet-propels itself off the bottom in hot pursuit. The white, belly side blends with the light filtering down through the water, protecting it from enemies below. The darker top side usually resembles the color of the bottom on which the flounder lives.

HABITAT

Flounder are found along almost every coastline of the United States. Among those found on the Pacific coast are the rex, petrale, English, Dover, sand, and rock soles, and the starry flounder. The Atlantic and Gulf coasts provide winter, summer, and yellowtail flounders, and a variety of soles. Most flounder live along the Continental shelf and slope, however, some come into shoal waters and are found in bays and close inshore along the coast.

FLOUNDER FISHING

More flounder are caught commercially with otter trawls than any other method. Sport fishermen use a variety of methods including angling and the use of a rod-type spear called a gig. The gig is used with a light to show the fish on the bottom and this method is used mostly in the Gulf and South Atlantic states.

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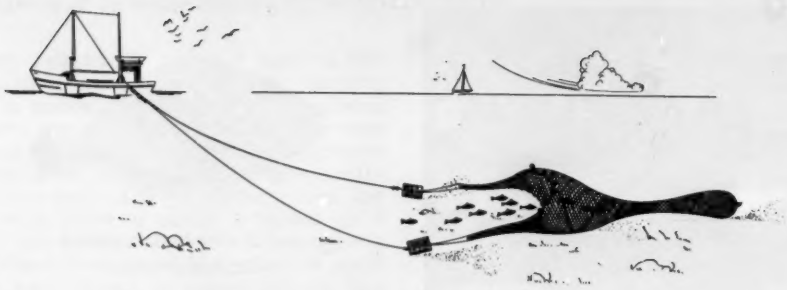

The otter trawl is dragged over the ocean floor to catch flounder.

CONSERVATION

In order to provide a variety of fish and shellfish for a growing population and a continuing resource for the fishing industry, cooperative State-Federal research and development efforts are needed. In recognition of these needs, Congress passed two major pieces of grant-in-aid legislation, the Commercial Fisheries Research and Development Act of 1964 and the Anadromous Fish Act of 1965. Through these Acts, the Secretary of the Interior, with BCF acting as administrator, has entered into cost-sharing cooperative agreements with the States and other non-Federal interests. In addition to the benefits already derived from the above Acts, BCF has developed a number of improvements which are proving beneficial to the fishing industry as a whole. Among these are trawl fishery improvement programs, such as a universal trawl capable of fishing at midwater depths as well as on the bottom, and an independently powered sonic instrumentation system to provide shipboard recordings of the fishing performance of otter trawls.

USES OF FLOUNDER

Flounder is considered one of the finest of all food fish. It has firm, white, delicate flesh that adapts to a wide variety of preparation methods. Most flounder and sole are filleted and can be purchased either fresh or frozen. Fillets vary in weight from 2 to 4 ounces and up to 8 ounces. Some flounder and sole are dressed and sold whole for stuffing. (National Marketing Services Office, BCF, U.S. Dept. of the Interior, 100 East Ohio, Room 526, Chicago, Ill. 60611.)

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THIS CHRISTMAS TREE IS SHRIMPLY DELICIOUS

In answer to many requests, the United States Department of the Interior's Bureau of Commercial Fisheries has once again released instructions for its Shrimp Christmas Tree for the most exciting holiday table in the neighborhood.

From a commanding position on a buffet table or as a colorful centerpiece for a well-appointed holiday dinner, this unusual tree is certain to capture compliments. Leafy green endive duplicates crisp holly while ever-popular shrimp add shape and color interest to this creative conversation piece.

This intriguing tree is elegant but deceivingly simple. The materials are readily available at most local variety stores and supermarkets.

SHRIMP CHRISTMAS TREE

3 pounds shrimp, fresh or frozen
2 quarts water
½ cup salt
4 large bunches curly endive
1 styrofoam cone, 2½ feet high
1 styrofoam square, 12 x 12 x 1 inch
1 small box round toothpicks
Cocktail Sauce

Thaw frozen shrimp. Place shrimp in boiling salted water. Cover and simmer about 5 minutes or until shrimp are pink and tender. Drain. Peel shrimp, leaving the last section of the shell on. Remove sand veins and wash. Chill. Separate and wash endive. Chill.

Place cone in the center of the styrofoam square and draw a circle around the base of the cone. Cut out circle and insert cone. Cover base and cone with overlapping leaves of endive. Fasten endive to styrofoam with toothpick halves. Start at the outside edge of the base and work up. Cover fully with greens to resemble Christmas tree. Attach shrimp to tree with toothpicks. Provide Cocktail Sauce for dunking. Serves 12.

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UNITED STATES DEPARTMENT OF THE INTERIOR

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.

Holiday Greetings

From The

Bureau of Commercial Fisheries

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